

We do not need another book that hands down the laws for the student to swallow, we do not need another technological cookbook. But we do need a "Beyer and Williams". Before discussing this book I would like to describe some of the characteristics which I consider essential for an introductory text if it is to give a glimpse of physics as the physicist knows it.

It must stress the limits and limitations of its description of each subject. From gravitation to radioactive decay there is very little room for the absolute statement without qualification. The student who is learning to solve problems without being fully aware of the restricted region in which his solutions apply is not learning physics.

This leads to a second characteristic of physics as opposed to that which is often taught under the name of *College Physics*. It is an open subject. The answers are not all known. Otherwise there would be no need for physicists. Even in the classical subjects there are many opportunities to demonstrate the limits of our knowledge. When we discuss kinetic theory, magnetism, even Ohm's law, we can point to the near frontier.

Finally an introduction to physics must stress the structure of the subject. It is not easy to describe the role of physical theory and its relation to the results of experiments, but without some attempt in this direction we can only have a cookbook. The student who has been led to believe that Newton's laws are self-evident is not only ill prepared for the transition to non-Newtonian physics, he has missed the most important lesson of the structure of mechanics.

Beyer and Williams must have had these characteristics in mind as they wrote their book. Perhaps the most striking feature of the book is its emphasis on the limits of validity of its statements. This sets the whole tone of the book and shows by example the caution of science and the dangers of extrapolation to the unknown. The spirit of physics as a continuing human achievement comes through very well, although specific examples of the limits of our knowledge and the subjects of current research are not often discussed.

Considerable effort has gone into the description of the structure of physical theory. There are several general sections at the beginning and again later in the book. Newton's laws are very carefully discussed, in a way that we do not expect in an elementary textbook. In the discussions of kinetic theory, geometrical optics, atomic structure, the authors again stress the way in which physics attempts to describe and correlate natural phenomena.

The structure of physics is often obscured in elementary books by a diffuse choice of topics. Here Beyer and Williams make one of their most significant contributions. They stick to the fundamentals of the subject and stay away from many of the peripheral topics which have caused traditional elementary physics to grow by formless accretion. Surface tension is not mentioned, friction is barely touched. Technological applications stay in the background and are never allowed to cloud the main development. Atomic bombs,

for example, are discussed in a chapter called "Applications of Nuclear Physics" together with radiation therapy and radiocarbon dating. Nor are there any gimmicks in the book; no pictures of power stations, or lightning, or exploding bombs.

Approximately one quarter of the book deals with "modern" physics. The careful explanations of the earlier chapters make the transition from classical physics more natural and less traumatic than is usually the case. As always the limitations are given as much weight as the successes.

Beyer and Williams' program and intentions are admirable. In some cases the execution of the program does not meet the high standards which they have set for themselves. In leaning over backwards to avoid a cut and dried presentation they sometimes obscure a lucid statement by the subsequent discussion. Is it necessary to talk of "those who accept the principle of conservation of momentum somewhat grudgingly"? (This sentence is given an ironic twist by the fact that their statement of the principle is questionable.) The introduction to work and mechanical energy is excellent. A section called "discussion of potential energy" destroys some of the clarity which the previous sections achieved. Similarly the description of simple harmonic motion is very clear, but in talking about simple harmonic motion the basic definition gets lost.

In view of the emphasis in most of the book it is surprising to see Coulomb's law stated with equal emphasis for vacuum and for a dielectric medium. Did the 1950 report of the American Association of Physics Teachers not discredit this practice sufficiently?

The virtues of this book are far more important than its defects. Beyer and Williams have written a text with individuality and fresh ideas. Their book is one of the best on its level and will undoubtedly have great influence on introductory courses and on future textbooks.

Numerical Methods. By R. A. Buckingham. 597 pp. Pitman Publishing Corp., New York, 1957. \$15.00. Reviewed by Robert T. Beyer, Brown University.

The theme of a great work of literature is very often established in the first sentence or paragraph of the book. It has therefore been this reviewer's practice to take special notice of this opening gambit. To be sure, the first words in scientific texts are not often of much interest and are quickly passed over. The opening of the text under review, however, is so striking, and so sets the theme of the book, that it bears repeating.

"What is the art of computation? This question may for the moment be answered as follows. Most calculations are carried out with numbers which are to some extent approximate, by methods which are often inexact, and their results, expressed in numerical form, are also approximate; yet there is normally only one answer which is correct to a specified degree of accuracy. The art of computation therefore lies in obtaining this correct answer with reasonable certainty, and with the least unnecessary labour."

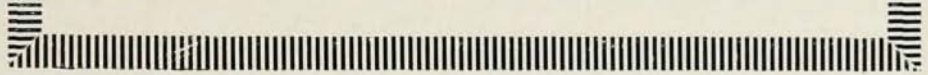



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L. Landau and Ya. Smorodinsky

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A concise presentation of some of the basic concepts of nuclear theory; based on a series of lectures to experimental physicists (by Landau) in 1954. Since there is no complete theory of nuclear forces at this time, conclusions about nuclear structure are limited to those based on experimental data, using only general quantum-mechanical relations. New experimental results are indicated.

English translation, 79 pages, \$15.00

THE PHYSICS OF FISSION—Supplement No. 1 to the 1957 Soviet Journal of Atomic Energy. English trans., 209 pages, \$30.00

THE THEORY OF THERMAL-NEUTRON NUCLEAR REACTORS, by A. D. Galanin. Suppl. No. 2-3, as above. English trans., 339 pages, \$60.00

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Throughout the work, which is impressively comprehensive in numerical methods performable on desk calculators, Dr. Buckingham keeps his mind on this definition of his art, and maintains at all times the very practical idea that speedy, accurate completion of the calculation is the fundamentally important matter, above and beyond the elaborateness of the method.

The book opens with a survey of tabulation errors, and then covers the usual ground of interpolation formulas and methods of divided differences, with applications to differentiation and integration. While most of this material has existed in the literature since the early 18th century, it is refreshing to find references to Aitken, Hartree, and Milne keeping pace with those to Newton, Stirling, and Bessel.

A very large section of the book is devoted to symbolic methods and to the solution of differential equations. A good deal of this material is algebraic in character, rather than numerical, but the two are very nicely wedged together. The coverage of differential equations extends to the standard quantum mechanical methods, such as perturbation theory, WKB, Hartree method, etc.

Following differential equations, the topics of iteration methods and curve fitting by least squares are presented. Matrix and determinantal methods are given in connection with solutions of simultaneous linear equations, and the text closes with chapters on integral equations and partial differential equations.

There is a large number (135) of worked examples scattered throughout the book, and about the same number of unsolved problems appears at the ends of the chapters. Thus the book is well adapted as an instructional text, as well as for reference work. Dr. Buckingham has furnished numerous references to literature in the field of computation. Especially useful are the references to the location of useful auxiliary tables.

This is a valuable book. Unfortunately it is also a high-priced book, so that it will probably be possessed mainly by libraries and reviewers. A cheaper edition would be highly desirable.

Books Received

SOVIET EDUCATION FOR SCIENCE AND TECHNOLOGY. By Alexander G. Korol. 513 pp. The Technology Press of Mass. Inst. of Technology & John Wiley & Sons, Inc., New York, 1957. \$8.50.

ADVANCES IN ELECTRONICS AND ELECTRON PHYSICS, Vol. 9. Edited by L. Marton. 347 pp. Academic Press Inc., New York, 1957. \$9.00.

REPORTS ON PROGRESS IN PHYSICS. Vol. 20, 1957. Edited by A. C. Stickland. 568 pp. The Physical Society, London, England, 1957. £3 3s; postage 1s 8d.

GUIDE TO THE MICROSCOPE. By Arthur Beiser. 127 pp. E. P. Dutton & Co., Inc., New York, 1957. \$3.25

PRINCIPLES OF MICRORADIOGRAPHY: Bibliography, Micro-radiography and Soft X-Ray Radiography. Prepared by Kodak Research Labs. 48 pp. Philips Electronics, Inc., 750 S. Fulton Ave., Mt. Vernon, N. Y., 1957. Paperbound, no charge.