Books

The Lloyd William Taylor Manual of Advanced Undergraduate Experiments in Physics. Thomas B. Brown, Editor-in-Chief. 550 pp. Addison-Wesley Publishing Co., Inc., Reading, Mass., 1959. $9.50. *Reviewed by Richard T. Weidner, Rutgers University.*

LABORATORY manuals usually do not make for exciting reading, let alone those written by a committee; but here is a most notable exception. This guide to experiments suitable for junior-senior-level laboratories, prepared under the auspices of the American Association of Physics Teachers with the suggestions and participation of hundreds of college physics teachers, is a fitting memorial to an outstanding teacher of physics.

The authors—R. H. Bacon (The Analysis and Interpretation of Experimental Data, and Mechanics), S. C. Brown (Atomic Physics), R. H. Howe (Electronics), R. R. Palmer (Radioactivity and Nuclear Physics), L. R. Weber (Acoustics), R. L. Weber (Heat), and F. T. Worrell (Electricity and Magnetism)—have gathered from many sources an extraordinarily comprehensive collection of advanced experiments. The old stand-bys are here; they are dealt with summarily, but often with clever variations or with improved techniques (the Franck-Hertz experiment using oscilloscope presentation). But new or little known experiments are here as well (an acoustic diffraction-grating experiment using a Venetian blind). It is probably safe to say that there is no intermediate undergraduate laboratory that cannot be improved with ideas extracted from this book and that no instructor, however great his experience, will not find here some new and ingenious laboratory method or procedure.

The directions are explicit: circuit diagrams, commercial suppliers, dimensions, and those subtle tricks that always seem to have been filtered out of technical papers are all given where they are needed. Moreover, the lists of references are long and detailed; they include papers in journals not often read by physicists. Perhaps most remarkable is the restraint that the authors show. A book of this sort might easily have become elephantine, but this book has only 550 pages.

This is not strictly a laboratory manual in the usual sense. It is, of course, a source of ideas to assist instructors in planning and setting up laboratory work, and it is a particularly useful reference book and guide to the student. But in addition, it can serve as a handbook of experimental techniques for physicists generally. There are, for example, fairly detailed treatments of low-temperature techniques and of acoustic impedance measurements. Although the WWV frequency standards are referred to several times, there is no listing of the broadcast frequencies.

It is said that Professor Taylor believed that "much of the value of laboratory work is lost unless the work is based upon thorough comprehension of the principles of the experiment *before* the student enters the laboratory" and that laboratory instructions should be specific, even dogmatic. This attitude is reflected in the book. The authors implicitly reject the suggestion, sometimes offered as the corrective to dull laboratory work, that students be turned loose in a laboratory full of assorted apparatus to re-enact (with broad hints) the crucial discoveries in physics. The "free" or "open-ended" laboratory may well be the ideal laboratory for ideal students, but this manual deals realistically with experiments for students as they are. Furthermore, there is little nostalgia for string and wax (and soda straws). The suggested experiments employ first-class modern equipment, but without contrived gadgetry.

The AAPT has made a distinctive contribution to the teaching of physics with this book on intermediate laboratory experiments. One can only hope that this will be followed by a comparable undertaking for the elementary laboratory.

Introduction to the Theory of Quantized Fields (Revised for English Ed.). By N. N. Bogoliubov and D. V. Shirkov. Translated from Russian by G. M. Volkoff. Vol. 3 of Interscience Monographs in Physics & Astronomy, edited by R. E. Marshak. 720 pp. Interscience Publishers, Inc., New York, 1959. $17.00. *Reviewed by Ernest M. Henley, University of Washington.*

THE *Introduction to the Theory of Quantized Fields* is the third volume of a series of monographs, edited by R. E. Marshak. Volume 1, *The Fundamental Constants of Physics*, by K. M. Crowe and J. W. M. DuMond, and Volume 2, by G. J. Dienes and G. H. Vineyard on *Radiation Effects in Solids*, were both published in 1957. The third text is a translation by George M. Volkoff, in the form of an enlarged and revised edition of a book first published in the USSR in 1957. George Volkoff is to be congratulated for an outstanding accomplishment. The English is so fluent that one never realizes that a translation has been performed.

The authors set themselves the formidable task of taking the reader from the theory of classical fields through quantum field dispersion relations in one volume. The word "introductory" in the title thus seems completely out of place. In fact, the emphasis throughout the text is on mathematical rigor rather than on physical insight. This makes the book more suitable for the research physicist than for the student who is first

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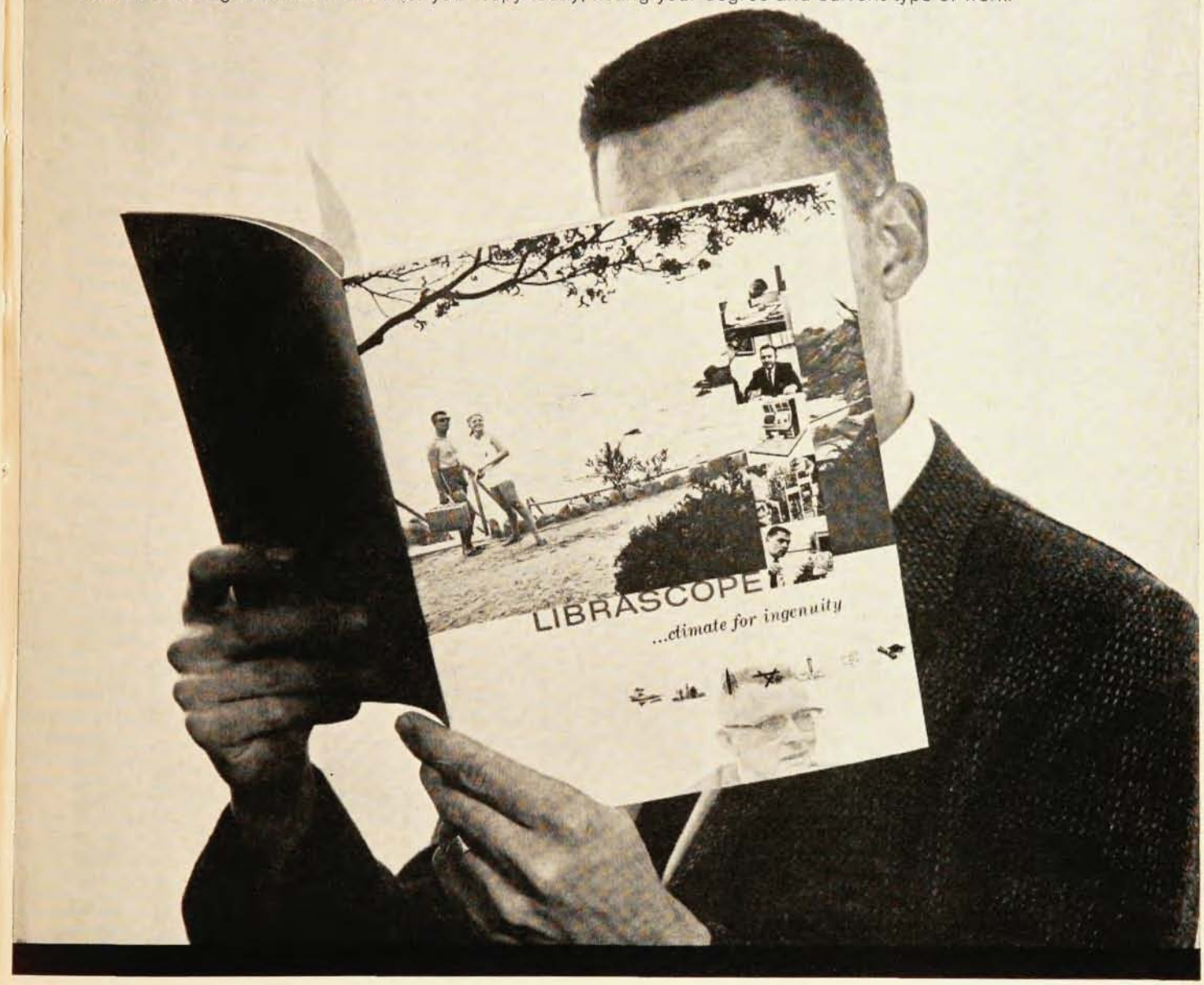

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trying to learn field theory. However, the latter can profit from the novel emphasis of Bogoliubov and Shirkov, which differs from that employed in most texts on quantum field theory.

In their introduction the authors give an excellent historical perspective of the development of modern quantum field theory. Early in the text they introduce covariant-contravariant four-dimensional notation and review the classical theory of fields, spinor algebra, the Dirac equation, and transformation theory. Among the applications, they discuss scalar, vector, and electromagnetic fields. They postulate the quantum conditions by means of the correspondence principle, and introduce the regularization of Pauli and Villars rather than compensating fields or cut-offs. Improper integrals and limiting sequences are carefully defined. In their treatment of the scattering matrix they prefer a method first introduced by Stueckelberg (which does not refer to the Hamiltonian or the Schrödinger equation) to the customary expansion of the Hamiltonian in the interaction representation. The authors almost immediately introduce the Bogoliubov form of the causality condition, which makes use of adiabatic switching on and off operators. The S-matrix is then developed in an expansion by means of the principles of relativistic invariance, unitarity, and causality. The connection to the more usual methods (e.g., Feynman diagrams) is made. In the removal of divergences mathematical analysis is emphasized, and applications through the third order in perturbation theory are given as examples. The classic examples of electrodynamics, e.g., vacuum polarization, anomalous magnetic moment, and the Lamb shift are also found in this text. Before coming to grips with dispersion relations, the authors finally discuss state functions, the method of functional averaging, and the renormalization group. In the chapter on dispersion relations the authors review the development up to two years ago and use the method of Bogoliubov to discuss both forward and nonforward dispersion theory for pion-nucleon scattering.

The presentation is thorough throughout. This reviewer found that the stress on mathematical rigor detracted from the orderly development, and hence from the understanding to be derived from a study of the text. However, for the nonneophyte in field theory, it offers a broadened scope through novel treatment. The authors thoughtfully relate their approach to the more classical one.

Theory of Unimolecular Reactions. By Noel B. Slater. 230 pp. Cornell U. Press, Ithaca, N. Y., 1959. $4.75. *Reviewed by Stuart A. Rice, Institute for the Study of Metals, The University of Chicago.*

BECAUSE of their intrinsic simplicity, unimolecular reactions have long been a favorite subject of study by theoretical chemists. In this short book based upon a series of lectures, N. B. Slater has presented a detailed description of his own contributions to the field. Although there is some new material, the book