sible to understand the structure of that solution sufficiently to venture a guess how small changes of the prescribed conditions might affect the overall solution. The situation is somewhat better in gas dynamics, for which the set of equations is classified as hyperbolic and one can gain a considerable amount of insight into the structure by employing the concept of characteristics. Characteristics are the paths of signals traveling with the local sound velocity. It so happens that along these particular paths the solutions obey ordinary differential equations and this fact brings them into a realm of mathematics in which our intuition is capable of functioning. Applicability of ordinary differential equations also leads to relatively simple integration procedures, exploitation of which is the main topic of Sauer's book. The title of the book is somewhat misleading because the text makes no reference to other well established methods of treating nonstationary flow.

After an introductory chapter on basic principles, the second one introduces the method of characteristics by discussing small-amplitude disturbances for which the sound velocity can be regarded as constant. In the remainder of the book this restriction is dropped. The third and fourth chapters deal with waves in which the pressure shows no discontinuity. The discussion covers their propagation in pipes with open and closed ends and modifications of the cross section of the pipe and the entropy of the fluid depend on the space coördinate; it also goes into graphical and numerical methods of integration. The next chapter introduces shock waves and treats the problems of their reflection from closed and open ends of a pipe and of their interaction with other shock waves or with rarefaction waves. The final chapter returns to problems without shock waves but adds the complication that the flow pattern may depend on two or three space coördinates. After generalizing the concept of characteristics the new formulation is used to devise a difference scheme for computing two-dimensional flow patterns.

According to the preface the book is supposed to stress numerical methods because of their significance when one uses high-speed computers. This discussion is not nearly as extensive as one could hope for. It is not mentioned, for example, how actual computations with these methods work and how they compare with those based on other methods. The discussion of shock-propagation computation furthermore, is limited to weak shocks. This limitation suggests that the use of characteristics to describe strong shocks has not caught up with, say, the artificial-viscosity method of Richtmyer and John Von Neumann. Because it appeals so directly to our physical insight, the theory of characteristics is esthetically very satisfying. It is not clear, however, that the method is really as practical as the author wants to make us believe.

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The reviewer, who is with Lockheed Aircraft, has an interest in hydrodynamics.

Focusing on basics

LABORATORY EXPERIMENTS IN PHYSICS. By W. Wallace McCormick. 171 pp. Macmillan, New York, 1966. Paper $4.95

by Henry S. Valk

In these days, when so many schools are in the midst of revising their undergraduate curriculums in physics and updating their laboratory experiments in introductory physics, this reviewer looked forward with considerable interest to examining the manual *Laboratory Experiments in Physics* by W. Wallace McCormick. The preface says that the experiments described have been used in introductory courses for engineers, liberal arts students and physics majors and it is the intent of these experiments to focus the students' attention on basic principles. Unfortunately, my expectations concerning the imaginative or innovative exposition of these principles were not borne out. Although the author is perhaps to be commended for not being carried away by the rising tide of innovation, I think that he has erred by adhering too closely to that which is traditional. In this regard one can cite such experiments as the "Vibration of an Air Column" to illustrate wave motion and the use of a pendulum to illustrate accelerated linear mo-

tion. Many experiments now available present the same physical principles to the student in a much more exciting way. For example, wave phenomena can be examined in the laboratory with a microwave apparatus and linear motion can be investigated with a linear air track.

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The reviewer, physics chairman at the University of Nebraska, has taught physics for more than a dozen years.

Authoritative introductory summarys and discussions

ADVANCES IN ATOMIC AND MOLECULAR PHYSICS, Vol. 2. D. R. Bates, I. Estermann, eds. 484 pp. Academic Press, New York, 1966. $16.50

by Bruce W. Shore

Students searching the literature for suitable topics for theses or research papers often find the task frustrating. Confronting journals or conference proceedings, they encounter a veil of jargon and brevity that shrouds the essential problems. Taking up a monograph, they sense a finality and completeness that leaves no room for their own effort. Fortunately, these difficulties have been recognized, and students are well advised to consult serials such as *Reports on Progress in Physics, Annual Reviews of Nuclear Science, Annual Reviews of Astronomy and Astrophysics, Progress in Optics* and, most recently, *Advances in Quantum Chemistry* and *Advances in Theoretical Physics*. The present volume, second of its series, is another such collection of research surveys. In my opinion, it is the best of this genre, and it will be widely appreciated by students as well as elder members of the physics community.

Each of the seven articles in the present volume provides thorough encyclopedic coverage of a specialized topic, with annotated compilations of data (both theoretical and experimental) and lengthy up-to-date bibliographies. The level of presentation is comparable to that in *Reports on Progress in Physics*. The individual topics are sufficiently specialized to permit discussion in depth; yet the collection as a whole has such breadth that anyone studying spectroscopy, atomic structure, collision processes, or transport phenomena should find here several articles applicable to his work. The authors particularly stress practical results, methods of computation, and applications of quantum theory. Thus their writings complement conventional texts on atomic physics, which concentrate more on formalism. The exposition of theory includes careful definitions and numerous footnotes, so that students with a working knowledge of intermediate quantum mechanics should have little difficulty following the discussion.

The lead article, by A. Dalgarno and W. D. Davison, "The Calculation of Van der Waals Interactions," points out the surge of interest over the past five years in the calculation and measurement of interatomic and intermolecular forces. Despite considerable effort by theoreticians, particularly Dalgarno and his colleagues, predicted forces are not entirely in accord with observations, and these authors suggest several possibilities for future work to resolve the discrepancy.

The fourth article, "The Measurement of the Photoionization Cross Sections of the Atomic Gases," is particularly timely. The author, J. A. R. Samson, has collected a wealth of illustrations and tabulations of published data. The resulting survey, basically empirical, should stimulate further experimental as well as interpretive effort.

W. R. S. Garton, covers "Spectroscopy in the Vacuum Ultraviolet" with thoroughness that belies the author's brevity. He proceeds beyond a review of contemporary laboratory equipment and illustrative spectra to a discussion of atomic structure as revealed by ultraviolet spectra. It is apparent that opportunities abound for investigations in the ultraviolet.

"The Theory of Electron-Atom Collisions" by R. Peterkop and V. Veldre is an excellent survey of collision theory, outlining the various practical methods that can be used to compute cross sections. This article is particularly useful for the numerous references to Russian work. A complementary article by F. J. de Heer reviews "Experimental Studies of Excitation in Collisions Between Atomic and Ionic Systems." These two surveys can serve well as the basic reference for a graduate course in atomic collisions.

In the remaining two articles S. N. Foner discusses "Mass Spectrometry of Free Radicals" and E. A. Mason, R. J. Munn, and F. J. Smith discuss "Thermal Diffusion in Gases."

I commend the authors and editors of this collection for providing seven examples of what a review article *should* be: an authoritative yet understandable introduction to a topic of current interest; a summary of past and contemporary work; balanced discussion of theory and observation; indications of problems requiring further work; and (rarest of all) a detailed index of subjects and authors. The book should be on the shelves of all physics libraries.

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The reviewer is a research fellow at the Harvard College Observatory and teaches graduate courses on atomic physics and spectroscopy in the Harvard astronomy department.

NEW BOOKS

NUCLEI

Many-Body Description of Nuclear Structure and Reactions. (Enrico Fermi School, Varenna, July 1965). C. Bloch, ed. 589 pp. Academic Press, New York 1966. $26.50

Neutron Noise, Waves, and Pulse Propagation. Conf. proc. (Gainesville, Fla., Feb. 1966) Robert E. Uhrig, ed. 771 pp. US Atomic Energy Commission, Washington, D. C., 1967. Paper $3.00

ATOMS & MOLECULES

Hyperfine Interactions. Conf. proc. (Aix-en-Provence, France, Aug. 1966) Arthur Freeman, Richard Frankel, eds. 758 pp. Academic Press, New York, 1967. $16.00

FLUIDS, PLASMAS

Electricity from MHD. Conf. proc. (Salzburg, July 1966) 2931 pp. in three volumes. International Atomic Energy Agency, Vienna, 1966. Paper $60.00 the set

Advances in Plasma Dynamics. Conf. proc. (Evanston, Ill., Aug. 1965) T. P. Anderson, R. W. Springer, eds. Northwestern U. Press, Evanston, Ill., 1967. $15.00