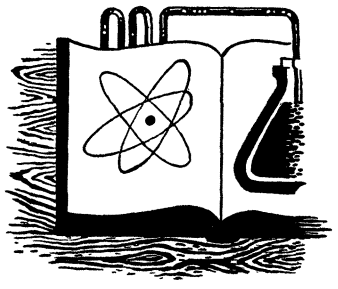
days of Linnaeus's American correspondents—Colden, Bartram, and Garden—and that he will take for his models in biographical writing such authors as Boswell, Macaulay, Fiske, and Parkman, whose scholarship never suffered from their artistry.

DONALD CULROSS PEATTIE

Santa Barbara, California



Scientific foundations of vacuum technique. Saul Dushman. New York: John Wiley; London: Chapman & Hall, 1949. Pp. xi + 882. (Illustrated.) $15.00.

This book is a monument to an era just concluded and a marker and a storage depot for the future. The era began with the invention of the condensation pump, and it ended spectacularly when vacuum went to war—high vacuum for radar and the fissioned atom, grand vacuum for magnesium and penicillin. During the intervening 30 years the gas-filled X-ray tube gave place to the Coolidge vacuum tube; the tungsten lamp and electronics came to maturity, and the molecular still was born. A regiment of subsidiary apparatus and measuring instruments sprang up and vacuum plumbing graduated from an unwelcome necessity to a hobby, then to an art, and recently to a science.

In 1922 Dr. Dushman published a little book called *High vacuum* which at once became the guide to a new territory. Shortly afterwards, many larger and more comprehensive books were written, mostly in the same pattern, but none placed the matter more succinctly. It has been evident for 10 years, however, that much new material has accumulated. It has been equally evident that the one man to make the authoritative compilation is Dr. Dushman because, as associate director of the General Electric Laboratories at Schenectady, he has witnessed or himself created nearly all that has transpired.

The *Foundations* is a reference book for scientists and advanced engineers; it does not deal with vacuum in the chemical process industries. The first four chapters—perhaps the best in a very good book—cover the theory of gases (and even the highest vacuum on earth still contains much gas). The next chapters on pumps and gauges are authoritative and comprehensive rather than selective. The later chapters dealing with adsorption, getters, solubility of gases in metals, and diffusion of gas through metals, are encyclopedic. On vapor pressure, the dry or electronic field is fully covered, but pump fluids only meagerly. The references and indexes are splendid. It is difficult to assess the merits of a book that has no rivals; suffice it to say that it stands alone. Practically every laboratory, regardless of its avowed purpose, will find a place for this book.

KENNETH C. D. HICKMAN

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Quantum mechanics. Leonard I. Schiff. New York: McGraw-Hill, 1949. Pp. xii + 404. (Illustrated.) $5.50.

Schiff's new textbook *Quantum mechanics* will be a very great help to anyone who studies this fundamental subject, which by now is taught to every student of physics. There is no other field in physics which poses more and harder problems to the teacher. Explaining the fundamental concepts of quantum mechanics is the most difficult of tasks, and no really clear way of doing it has yet been found. However, every student must not only be acquainted with these fundamental concepts, but also be able to apply them in his research work. Quantum mechanics also uses a great number of very complicated mathematical formalisms to which the student must be introduced. This is the easier part of the course, and too little emphasis is usually given to the exposition of the fundamentals.

The present book is distinguished in this respect from most of the older, widely used textbooks. The first chapter contains a well-presented description of the fundamental concepts of measurement and complementarity. It introduces the reader into the problematics of the subject but does not relieve the more serious student from the study of books like the ones by Dirac or Kramers, and the classical papers of Bohr. The Schroedinger wave equation is introduced in the second chapter by using the experimental relation between frequency and wavelength. This emphasizes the connection with experimental facts, which is sometimes missing in more dogmatic representations. The following chapters are very much along conventional lines, but are written with great care and with emphasis on detailed and elegant derivations. The book differs from the usual introductions into quantum mechanics by a strong emphasis on collision theory. This is a great advantage in view of the increasing application of quantum mechanics to nuclear collision problems.

One notices a change in style beginning with Chapter 9, when the problems of many particles are treated and when radiation is taken into account. Less emphasis is placed on detailed description and the book takes on more of the character of a survey than before. These chapters include discussion of identical particles and the spin of the electron, and a semi-classical treatment of radiation and of the spectra of atoms and molecules. The last three chapters form a separate unit, on the relativistic wave equation, and the quantization of the wave fields, and a short introduction into quantum electrodynamics; they represent, therefore, what is taught in most schools in a separate course on advanced quantum mechanics.

A few details could perhaps be criticized from the point of view of the reviewer, who has probably ac-

quired a too-narrow idea of how to teach this subject. One of the most important concepts for the understanding and practical application of quantum mechanics is angular momentum. The treatment of this concept could have been more extended. There is, for example, no reference in the book to the fact that the angular momentum operators are the operators of infinitesimal rotations. The addition of angular momenta as applied to many-particle problems is mentioned, but has not received a very thorough discussion. This textbook, as well as most of the others, refer the reader to the book by Condon and Shortley, whose treatment, however, is much too exhaustive—the reviewer has found that it frightens away most of the students who want to study it. It is hoped that some textbook will provide an elegant and simple treatment of this field. The spin of the electron does not get the attention it deserves. The fact that the electron wave function has two components is derived in too formal a manner. A discussion of the transformation properties of these components, if the coordinate system is rotated, is necessary for the understanding of the spin.

Schiff's book has many values for teachers and students, not the least of which is its collection of first-rate problems. Too few textbooks on quantum mechanics can be used for a graduate course. There are many ways of teaching the subject and there is a great need for textbooks with different approaches. Although the present book in many respects follows the conventional lines, it does bring in new ideas and approaches and will contribute to a better understanding and better teaching of quantum mechanics.

VICTOR F. WEISSKOPF
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Physical aspects of colour: an introduction to the scientific study of colour stimuli and colour sensations. P. J. Bouma. New York: Elsevier (U. S. distributors for Philips Technical Library, Eindhoven, The Netherlands), 1948. Pp. 312. (Illustrated.) $5.50.

It is a pleasure to review this remarkable summary of the principles and techniques of modern measurement of color. Dr. Bouma spent the last two years of his life to produce what he knew would be his last work, and he has achieved a brilliant climax to a distinguished career in illuminating engineering.

Starting from a novel yet perfectly sound approach, Dr. Bouma presents the concepts and laws on which the measurement of brightness is based—the Maxwell color triangle and the standard ICI colorimetric coordinate system and its relation to dominant wavelength and purity, to color temperature, to boundary, ideal, optimal, and full colors, and its use in the reduction of spectrophotometric data. He then passes to visual colorimetry, defective color vision, discrimination of color differences, the Munsell color system, and hue and saturation of object colors in connection with chromatic adaptation of the eye.

Dr. Bouma does not skip over the hard parts, but goes in simple language to the knot of each problem, often with a mathematical proof. The book is further remarkable for its completeness. All important colorimetric techniques are not merely described; they are appraised with consummate skill and judgment.

In spite of the direct style and excellent translation into English, the book is not easy reading. It has to be studied, not merely read. The facts and concepts of modern colorimetry cannot be adequately grasped by the layman, however intelligent he may be, in a few hours. Here is a clear account of these facts and concepts by a world master whose comprehension of the recent extensive American literature will probably not be matched by an American author for some years to come. Dr. Bouma's book meets a unique and long-felt need, and should be available to every serious student of color.

DEANE B. JUDD
National Bureau of Standards

Practical spectroscopy. George R. Harrison, Richard C. Lord, and John R. Loofbourow. New York: Prentice-Hall, 1948. Pp. xiv + 605. (Illustrated.) $6.65.

The authors of this extremely useful and interesting reference book have operated in recent years the spectroscopic laboratory of the Massachusetts Institute of Technology and have felt (quoting from the preface) "the need of a text and reference book that would help the worker in any branch of science to evaluate the aid which the techniques of spectroscopy might lend to the solution of his problems. In our attempt to fill this need, we, as a physicist, a chemist, and a biophysicist, respectively, have tried to synthesize our three viewpoints in a way that would be useful to all who use, or might use, the techniques of experimental spectroscopy."

They have produced a book that will be valuable and interesting to all of us who have made constant use of the spectrograph, and will fulfill the requirements of the beginner as well. For example, in the chapter on the photography of the spectrum (page 154) I find a suggested routine to follow in transferring a plate from the box to the plateholder in a perfectly dark room, in order to be spared the embarrassment of finding, on turning up the lights, an open box of plates awaiting disposal.

The beginner will find in the first chapter a very brief history of the development of the spectroscope, its construction and operation, and its use in physics, chemistry, biology, medicine, metallurgy, food research, and criminology. Chapters 2 to 5 are devoted to the selection of spectroscopic instruments and the use of prisms and diffraction gratings, together with the fullest details on their adjustment and methods of illumination.

Chapter 7 covers the photography of the spectrum, dealing with practically everything connected with the selection and development of plates and with common defects in spectrum photographs and how to avoid them. Chapter 8 offers a very full description of the various types of light sources for spectroscopy, low temperature thermal emission, metallic arcs, high and low pressure mercury arcs, spark discharges, and vacuum tubes.