parts of mathematical machinery needed later. The second chapter introduces wave mechanics and the third chapter takes up simple examples of energy eigenfunctions, ending with the angular functions for a spherically symmetric potential and the properties of the angular momentum operator. This last material is used, in the fourth chapter, as an example to illustrate the discussion of general quantum principles, of operators, of the uncertainty principle and commutability.

The fifth chapter deals with the matrix formulation of quantum mechanics and the sixth applies this to a general discussion of the angular momentum operators for systems of particles. Here the Pauli spin operator is introduced, several examples of the addition of angular momenta are worked out and the Pauli principle for identical particles is discussed.

The seventh chapter gives an elementary discussion of perturbation theory and the eighth chapter takes up collision problems, introducing the integral equation formulation, the Born approximation and the time-dependent approach. The last chapter is an introduction to group theoretical ideas and their application to spin operators and to the formulation of selection rules. At the end of each chapter are a dozen or so problems, with answers discussed at the back of the book. There are an appendix listing vector formulas, a short bibliography, and a 2½-page index.

The style is easy and understandable. Conceptual and mathematical difficulties are pointed out and, where they are not discussed thoroughly, reference is made to more complete treatments. Although many subjects, not included here, should be in an introductory course in quantum mechanics, this text can provide the appropriate order and the basic framework for such a course. This reviewer considers it the best of the recent batch.

The Elements of Probability Theory and Some of its Applications. By Harald Cramér. 281 pp. (Almqvist & Wiksell, Sweden) John Wiley & Sons, New York, 1955. $7.00. *Reviewed by Harold W. Kuhn, Bryn Mawr College.*

This book is an introduction to probability theory; it has been planned with great care for the reader who has some working knowledge of analytic geometry, calculus, and determinants, but who is not prepared for more advanced treatises such as Feller's *Probability Theory* (Vol. I, John Wiley & Sons, 1950) or Cramér's own *Mathematical Methods of Statistics* (Princeton University Press, 1946). The treatment emphasizes the statistical applications without losing sight of the fact that the mathematics of statistics is but a part of the mathematical theory of probability.

The volume is divided into three parts: foundations; random variables and probability distributions; applications. Although this arrangement is reminiscent of the author's *Mathematical Methods*, the content differs both in level and in subject matter. The first part traces the historical development of the concept of probability and exposes in a lucid style the author's view that it is "a mathematical model for the description and interpretation of phenomena showing statistical regularity". Probabilities are only defined for events attached to some random experiment which can be repeated several times under uniform conditions. The remainder of this section is devoted to deriving the elementary rules for calculating probabilities and some simple applications.

The second part provides the bridge between probability theory and statistics. It treats the basic properties of random variables and discusses in some detail the more common distributions. In proving various theorems (for example, the central limit theorem) the author settles for a proof of a special case and states more general results with appropriate references to the literature.

The third part of the book deals with statistical practice. Although the space is limited (107 pages), the topics chosen for treatment are handled with great clarity. The reviewer found the last chapter, which discusses the theory of errors, regression problems, analysis of variance, sampling, and quality control, to be particularly distinguished.

Numerous problems, appended to each chapter, enhance the value of the book as a textbook, as do the well-chosen historical references. Tables of the $\mathbf{X}^2$, normal, t and F distributions are included.

Proceedings of the Northwestern University Conference on the Training of College Physics Laboratory Assistants. Edited by C. J. Overbeck. 168 pages. Northwestern University, Evanston, Ill. 1954. Paperbound. *Reviewed by E. C. Watson, California Institute of Technology.*

The problem of improving the quality of laboratory instruction in the general physics courses is engaging the attention of most college physics departments at the present time. The problem is most acute in the larger institutions in which hundreds of students must be accommodated in the general laboratory and graduate assistants must be used.

A nationwide conference to study this problem, planned and organized by S. C. Brown of the Massachusetts Institute of Technology, C. J. Overbeck of Northwestern University, and C. N. Wall of the University of Minnesota, and supported by a grant from the National Science Foundation, was held at Northwestern University on June 25 and 26, 1954. It was attended by more than forty of the physicists who have the responsibility for directing the general physics laboratory work at their respective institutions. The publication under review is a full and carefully edited account of this conference.

While the whole report should be read if full justice is done to the conference, the main results were summarized by a Committee on Conclusions under the following headings:

(1) *The Purpose of Laboratory Work.* The most important factor contributing to good laboratory instruction was felt to be a clear understanding of the objectives and purposes of the laboratory in general and the laboratory course in particular. (2) *Motivation.* A number of suggestions were made for the motivation of the teaching assistants. (3) *Pre-Term Indoctrination.* It was recommended that the week prior to the opening of classes be used for the indoctrination of the teaching assistants. (4) *Staff Meetings.* A number of suggestions were made for the conduct of the weekly staff meetings. (5) *Evaluation.* Two methods for evaluating the performance of teaching assistants were recommended. (6) *Methodology and Administration.* Various techniques of teaching and the preparation for teaching on the part of the teaching assistants were discussed.

A careful reading of the whole report is recommended to all teachers of college physics.

Physical Measurements in Gas Dynamics and Combustion. Edited by R. W. Ladenburg, B. Lewis, R. N. Pease, and H. S. Taylor. 578 pp. Princeton University Press, Princeton, N. J., 1954. $12.50. *Reviewed by Abraham S. Friedman, National Bureau of Standards.*

Increased interest and activity in the fields of aerodynamics and gas dynamics have produced a correspondingly rapid development of experimental techniques for physical measurements in gas dynamics. Volume IX of the *High Speed Aerodynamics* and *Jet Propulsion series* is concerned with physical measurements in gas dynamics and combustion.

The first part of the book, edited by the late Professor Ladenburg, presents an excellent survey by various authors of the applicable experimental methods. In addition to clear expositions of the classical optical methods of measuring densities—shadow, schlieren, and interferometric—several newer procedures are discussed. These include electrical discharge and after-glow methods; oxygen, ozone, and mercury vapor spectral absorptino methods; and techniques involving the absorption of soft x-rays, α particles, protons, and electrons. The pressure measuring techniques reviewed are, in the main, conventional. There is a short discussion of the Pitot tube and a survey of manometers, vacuum gages, diaphragm gages, piezoelectric gages, etc. Several interesting methods of measuring air speeds are described. The ionization anemometer is based on timing the flow of a small quantity of ionized gas from the point of ionization to a detector downstream. Velocities are also measured by timing the flow of illuminated particles. The determination of local and instantaneous velocities can be accomplished by use of various types of discharge anemometers which are described. For wind tunnel use, the acoustic Mach meter is applicable. The measurement of the velocity of shock waves by the light screen technique is the subject of a short chapter. Other shock front measurements by light reflectivity are reviewed. Modifications of the classical methods of temperature measurement, applicable to shock tube and wind tunnel studies, are described. These include resistance thermometry, thermoelectric couples, radiant energy emission, and acoustic thermometry. An interesting section is devoted to procedures for studying turbulence. Analogue methods using the water table and the hodographic tank are described.

Part 2 of this book is concerned with physical measurements in combustion. This part, edited by H. S. Taylor, B. Lewis, and R. N. Pease, reviews the latest methods of measuring flame temperatures, pressures, and velocities. There are also review chapters on flame photography and mass and optical spectroscopy. Part 2 is of particular value to those chemists, physicists, nad thermodynamicists interested in the extremely important and rapidly expanding fields of research related to high-temperature phenomena.

Many of the techniques described in this volume are applicable to the study of a wide variety of other phenomena and hence the book is properly addressed to a reading audience not restricted to aerodynamicists and combustion chemists.

Théories Relativistes de la Gravitation et de l'Électromagnétisme. By A. Lichnerowicz. 298 pp. Masson et C^{ie}, Paris, France, 1955. 2800 francs. *Reviewed by T. Teichmann, Missile Systems Division, Lockheed Aircraft Corporation.*

In this book Lichnerowicz has given an extremely elegant and clear account of the mathematical structure of the theory of general relativity, together with a discussion of some essays at unified field theories. In accord with the modern mathematical spirit which underlies the work, the basic geometrical ideas of the theory are brought to the fore, and the results are derived with great clarity, and without overwhelming formal tensorial techniques.

The first part of the book treats general relativity proper. After describing the underlying geometry, the Einstein equations are written down, and the energy-momentum tensors for pure matter, perfect fluids, and electromagnetic fields introduced, and several of their basic properties derived. A discussion is then given of the Cauchy problem and the consistency conditions for electromagnetic and gravitational fields. The next main section then gives a comprehensive discussion of relativistic hydrodynamics, including perfect charged and uncharged fluids, and viscous fluids. This section is extremely well done, but regrettably contains no reference to the work of Taub and McVittie on similar topics. The last section of the first part contains a global study of stationary space-time, and is basically a generalization of ordinary potential theory. Throughout this first part, as indeed throughout the entire book, the really important results are stated as theorems and printed in heavy type, which makes them extremely easy to refer to.

In the second part of the book, the author has chosen