

ELECTRON OPTICS SPECIALIST

- To work with a progressive metallurgical group in an ultra modern Research Laboratory.
- Finest facilities, including RCA and Hitachi HU-11 microscopes and an ARL electron microprobe.
- Opportunity provided to conduct individual research in microscopy.
- This position requires a minimum of 3 years experience in microscopy and diffraction or an advanced degree in the theory of electron optics.

Scientific Laboratory

OF THE

FORD MOTOR COMPANY

Send complete resume to

Salaried Placement Section

Engineering and Research Staff

P.O. Box 2053, West Dearborn, Michigan

and the highly advanced monographs (such as L. H. Aller's *Gaseous Nebulae*, also published by John Wiley and Sons, Inc.). We urgently need in the English language a book (or even a translation) resembling the *Lehrbuch der Astronomie* by E. and B. Strömgen, or the *Astrophysique Générale* by J. C. Pecker and E. Schatzman, or the *Kurs Astrofiziki i Zvezdnoi Astronomii* by several Russian authors.

The Nature of Physical Knowledge. L. W. Friedrich, ed. 156 pp. Indiana U. Press, Bloomington, Ind., and Marquette U. Press, Milwaukee, Wisc., 1960. \$4.50. *Reviewed by R. Bruce Lindsay, Brown University.*

PHYSICISTS with a philosophical turn of mind and philosophers with an interest in physics never cease to ask themselves what the physical researcher is really up to and what is the essential nature of this physical knowledge which seems so powerful and is increasing at such an accelerated rate. The book under review is the result of a symposium on this general subject held at the meeting of the American Physical Society in Milwaukee in the summer of 1959, largely at the suggestion of Henry Margenau. It consists of a series of brief essays by some well-known physicists and some philosophers not so well known to most physicists, a group of seven in all. A final chapter consists of a tape transcription of the discussion which followed the symposium presentations.

Though all the essays are in some measure related to the main theme of the nature of the knowledge which the physicist acquires and works with in his investigations, inevitably such a collection lacks coherence and organization, since each author has naturally followed his own interpretation of the subject and in certain cases has merely emphasized one facet of the whole theme of recent interest to himself.

The volume opens with an examination by P. W. Bridgman of the circumstances under which the word "knowledge" is used in connection with the activities of the physicist. After stressing the role of operational verification in the physicist's conception of "knowledge", he cites the great influence of quantum theory in altering earlier views. He winds up with the observation that to understand the nature of knowledge in the physical sense one must ultimately study the atomic structure of the brain.

The contribution by the philosopher, Frank J. Collingwood of Marquette University, is devoted mainly to a historical study of the place of mathematics and quantitative ideas in physics. He concludes that we shall never really get away from qualitative ideas.

Two of the essays, namely those of Henry Margenau and Adolf Grünbaum, explore the role of a priori elements in physical theory. Margenau raises the question: Are such elements really necessary? His answer is of the yes-and-no variety. If certain, unchangeable, and eternal explanations are sought in physics, the answer is yes: Everything then is based on a priori propositions. But if by such propositions we mean constructs

which are isolated from demonstrable ones and are effectively inaccessible to demonstration, the answer is no. The argument is ingenious, but many will wonder about its value for the psychology of invention in physics, since physicists will presumably go merrily on pushing their imagination to the limit in the endeavor to understand experience. Grünbaum's handling of the a priori is largely confined to his attempt to refute Duhem's conclusion that there is no such thing as a crucial experiment. He appears to succeed in weakening Duhem's argument to a certain extent without, however, completely invalidating it.

The well-known theoretical physicist, Alfred Landé, provides a boiled-down version of his attempt to restore unitary reality to the prevailing dualism in the interpretation of quantum mechanics. To understand his point of view in detail the reader must, however, turn to Professor Landé's numerous more formal expositions of the past few years.

The relevance of physical knowledge for ethics is discussed by George P. Klubertanz, S.J. Finally, Raymond J. Seeger endeavors to sum up the significance of the symposium as a whole and succeeds in emphasizing the essential difficulty in any undertaking of this kind, namely, the lack of any uniform definition of the terms used by the participants. The book raises many stimulating questions but scarcely settles anything. It is of course unreasonable to expect philosophy to do so.

Underwater Acoustics Handbook. By Vernon E. Albers. 290 pp. The Pennsylvania State U. Press, University Park, Pa., 1960. \$10.00. *Reviewed by M. A. Breazeale, Michigan State University.*

FEW media for the propagation of sound, except possibly the Earth's crust, are as vexing in their defiance of simple, all-encompassing description as the ocean. Thermal gradients, surface and bottom reflections, various types of discontinuities, and even snapping shrimp join together in a haphazard fashion to make the interpretation of acoustic measurements difficult. The difficulties do not stop here, however. It is apparent from this book that they extend into the organization of descriptive literature on the ocean as well.

The difficulty in organization is exemplified by the fact that an equation relating the velocity of sound in the sea to temperature, density, and salinity is not to be found in the section entitled "Velocity of Sound in the Sea". Rather, it is found under "Refraction, General". Such displacements are concentrated primarily, although not exclusively, in the introduction where they do a minimum of damage, except possibly to scare away potential readers. The other three parts are better organized.

In Part 2, "The Medium", the factors affecting sound transmission are well described. Ray diagrams illustrate clearly how the sound path deviates from a straight line under certain conditions and show the strange effects which can then result. The effects of discontinui-

ANIMAL FEEDS

BALLISTICS MISSILES

CANDLES

DISTRIBUTION PROBLEMS

*all have one
thing in common*

They are or have been subject to study by the staff at Arthur D. Little, Inc.

It would be impossible to include in any list the diversity of fields in which our scientists, engineers, technical economists and other specialists have made a contribution.

Founded in 1886, ADL is now one of the world's oldest, largest and most versatile industrial research organizations. We augment the extensive research and development efforts of some of the nation's leading corporations, and many small companies consider us their "research department." The steady increase in the use of outside industrial research consultants by business, industry and Government is reflected in the steady growth of Arthur D. Little, Inc.

We consider exceptional manpower our richest resource. Only top research results, given to a client in useful form by an ADL staff possessing and maintaining the highest professional standards, can assure mutual continued growth and success.

Current areas of research interest now include solid state, high temperature materials, low temperature physics, resonance physics, superconductive films, optics and peripheral research areas.

For further information, send a brief description of your education and professional experience to Donald F. Sweet.

Arthur D. Little, Inc.

**35 Acorn Park
Cambridge 40, Massachusetts**

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.