

now is a single entity more than it ever was before, perhaps more so than the casual reader will realize from von Laue's book. The reader who may wish to ponder on the interrelation of the various disciplines would derive much assistance from a chronological listing of the most important landmarks in the history of our science.

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Books Received

THE HUMAN USE OF HUMAN BEINGS. By Norbert Wiener. 241 pp. Houghton, Mifflin Company, Boston, Massachusetts, 1950. \$3.00.

THE INELASTIC BEHAVIOR OF ENGINEERING MATERIALS AND STRUCTURES. By Alfred M. Freudenthal. 587 pp. John Wiley and Sons, Inc., New York, 1950. \$7.50.

STELLAR EVOLUTION. By Otto Struve. 266 pp. Princeton University Press, Princeton, New Jersey, 1950. \$4.00.

MECHANICS AND PROPERTIES OF MATTER. VOLUME I OF A TEXTBOOK OF PHYSICS. By R. C. Brown. 285 pp. Longmans, Green and Company, New York, 1950. \$2.25.

KLEINSTE DRUCKE IHRE MESSUNG UND ERZEUGUNG. By Rudolf Jaekel. 302 pp. Springer-Verlag, Berlin, Germany, 1950. DM 39.60.

THERMODYNAMIK. By E. Schmidt. 520 pp. Springer-Verlag, Berlin, Germany, 1950. DM 30.00.

LEITFADEN DER TECHNISCHEN WÄRMELEHRE. By Hugo Richter. 617 pp. Springer-Verlag, Berlin, 1950. DM 34.50.

MATRIX ANALYSIS OF ELECTRIC NETWORKS. By P. Le Corbeiller. 112 pp. Harvard Monographs in Applied Science. Number 1. Harvard University Press, Cambridge, Massachusetts. John Wiley and Sons, Inc., New York, 1950. \$3.00.

ACHEMA YEAR BOOK 1940/50. Deutsche Gesellschaft für Chemisches Apparatewesen, Frankfurt, Germany, 1950.

THE STRUCTURE OF MOLECULES AND THE CHEMICAL BOND. By Y. K. Syrkin and M. E. Dyatkina. Translated and Revised by M. A. Partridge and D. O. Jordon. 509 pp. Interscience Publishers, Inc., New York, 1950. \$8.75.

PRIMARY BATTERIES. By George Wood Vinal. 336 pp. John Wiley and Sons, Inc., New York, 1950. \$5.00.

THE EARLY DEVELOPMENT OF THE CONCEPTS OF TEMPERATURE AND HEAT. THE RISE AND DECLINE OF THE CALORIC THEORY. Prepared by Duane Roller. 106 pp. Harvard Case Histories in Experimental Science. Harvard University Press, Cambridge, Massachusetts, 1950. \$1.25.

ELECTROMAGNETIC THEORY. By Oliver Heaviside. 386 pp. (Unabridged edition of Volumes I, II, and III of Heaviside's work) Dover Publications, New York, 1950. \$7.50.

POCKET ENCYCLOPEDIA OF ATOMIC ENERGY. By Frank Gaylor. 204 pp. Philosophical Library, New York, 1950. \$7.50.

ELECTROMAGNETIC FIELDS, THEORY AND APPLICATION. VOLUME I. MAPPING OF FIELDS. By Ernst Weber. 590 pp. John Wiley and Sons, Ltd., New York, 1950. \$10.00.

ASTRONOMY. By Robert H. Baker. (5th Edition) 526 pp. D. Van Nostrand Company, Inc., New York, 1950. \$4.75.

ELECTRON-TUBE CIRCUITS. By Samuel Seely. 529 pp. McGraw-Hill Book Company, New York, 1950. \$6.00.

A MANUAL OF ELECTRICAL MEASUREMENTS. By Robert Quinly Gregg, Harry Emmons Hammond, and Robert Hartwig Frost. Addison-Wesley Press, Inc., Cambridge, Massachusetts, 1950. \$2.50.

Journal notes

■ Polarization

The ionosphere is a region of charged particles above the earth which owes its existence to ionization of atmospheric gases by ultraviolet radiation from the sun. Knowledge of the structure and characteristics of the ionosphere is necessary for predicting its effect on radiowave propagation. Much information can be obtained by observing the echo reflected from the region when a strong pulse of radio frequency energy is directed toward it from the ground. Because the earth's magnetic field renders the medium doubly refracting to radio waves, the reflected wave usually is elliptically polarized. An instrument has been developed capable of measuring precisely the orientation and dimensions of the polarization ellipse.

The 1.5 megawatt transmitter with which the polarimeter is used emits a 150 microsecond pulse of radio frequency energy every 0.64 second on a carrier frequency of 150 kilocycles per second. The downcoming elliptical echo is resolved into two quadrature components by crossed loop antennas. The components are amplified with equal gains and phase shifts by two identical, broadband, superheterodyne receivers, and then connected to an oscilloscope which displays the original ellipse. The direction of rotation of the ellipse is determined by shifting the phase of one receiver output 90 degrees, and using this signal to turn off the oscilloscope intensity on every half cycle. The resulting Lissajous figure reveals the direction of rotation.

The observations are recorded photographically at a rate of one every 3 to 5 seconds, and the film is scaled for the ratio of axes, the angle of tilt, and the direction of rotation.

Measurements on the electric vector indicate that the polarization is, in general, elliptical with the major axis of the ellipse tilted east of magnetic north, and that only left-handed polarization is present which corresponds to the ordinary ray in the Northern Hemisphere. These results check well with simple ray theory.

H.J.N.

A Polarimeter for the Study of Low Frequency Echoes. By A. H. Benner and H. J. Nearhoof. *Rev. Sci. Inst.* 21: 830, October, 1950.

■ Conductivity of an Electron-Proton Gas

Previous detailed analyses of conductivity in gases, developed by Enskog, Chapman, and others usually involve the tacit assumption that each collision between two molecules involves a large change in their velocities, either in magnitude or direction. In a gas consisting entirely of protons and electrons this assumption is not realistic. The velocity of a single electron changes frequently by relatively small amounts, with each change produced by a relatively distant encounter with another electron or with a proton. The cumulative effect of these small velocity changes gradually produces large changes in the velocity of an electron. Thus the position of an electron in velocity space changes in the same way that the physical position of a particle changes in Brownian motion, where the cumulative effect of many small displacements is also relevant. The differential equations developed to describe the effect of Brownian motion on the spatial distribution of a set of particles may be