

of events occurring in deep space, e.g., birth and death of stars in galactic systems, interaction between galaxies. Here, again, the Doppler shift of the hydrogen line is a powerful tool, especially when compared with the shift of the optical spectra. In their conclusion, the authors state that it is not easy to disentangle the most important contributions of radio astronomy to the understanding of the universe. Their book, however, can be highly recommended as a guide to the discoveries disclosed by radio astronomy.

Yankee Scientist—William David Coolidge. By John Anderson Miller. 216 pp. Mohawk Development Service, Schenectady, N.Y., 1963. \$3.95.

Reviewed by R. B. Lindsay, Brown University.

The history of science is to a great extent the story of the men whose ideas and achievements have become a part of our scientific heritage. Hence scientific biographies assume an important role in education and in particular in the training of scientists. While no amount of reading about how great scientists tackled their problems can necessarily make a young person into a successful scientist, a good biography can provide valuable stimulus to the mind prepared to receive it.

William David Coolidge has had a long and eminent career as an industrial scientist, and it is highly appropriate that a biographical sketch of him should be made available. Mr. Miller has done a good job of providing this in the relatively short compass of 200 pages. At the same time he has added considerably to our understanding of the development of industrial research in applied science in the United States during the past sixty years.

The author traces in chatty style Coolidge's educational experience at the Massachusetts Institute of Technology, where he was a member of the class of 1896, and at the University of Leipzig, where he received his doctor's degree in 1899 with a thesis under Paul Drude on the dielectric constant of liquids. Back at the Institute in Cambridge he shifted to work in physical chemistry under Professor

A. A. Noyes and stayed there until 1905, when Dr. Willis R. Whitney persuaded him to join the staff of the newly organized Research Laboratory of the General Electric Company in Schenectady. He remained in this activity for thirty-nine years, during the last twelve of which he served as director of the Laboratory.

Mr. Miller describes in relatively simple fashion Coolidge's researches on the production of ductile tungsten, his achievements in the production of high power x-ray tubes, and his First World War work in underwater sound. Ample attention is also paid to Coolidge's important contributions to better public understanding of the role of industrial research in the nation's economy.

This is by no means a profound and searching study, but it does provide an engaging picture of the trials, problems, and success of a distinguished scientist. It should be read with interest by all physicists.

Thermal Physics. By Philip M. Morse. 455 pp. Benjamin, New York, 1964. \$10.50. *Reviewed by Bruce W. Shore, Harvard College Observatory.*

As the title suggests, this book covers the disciplines of physics in which thermal properties are important—the subjects often treated separately as thermodynamics, kinetic theory, and statistical mechanics. It is intended for textbook use in a one-semester senior-graduate course that provides the necessary foundation for strictly graduate-level study in physics and engineering. Thus this text presents thermodynamics as an important tool for the physicist, rather than as an end of its own. The reader is constantly reminded of the many ways he will be building upon this subject in graduate study.

Many physicists are already familiar with the earlier "preliminary edition" of this work, published as a paperback (at \$4.50) in 1961. The present hardbound "revised edition" is an expansion from 276 to 455 pages, bringing in important new examples and clarifying several sketchy points of the earlier edition. The number of problems was roughly doubled, to a new total of 123.

The text is divided into three main sections: Thermodynamics (ten chapters), Kinetic Theory (five chapters), and Statistical Mechanics (twelve chapters). Each chapter fits into a clearly defined plan, progressing from macroscopic properties of matter to a microscopic atomic description. Yet the author does not hesitate to inject atomic-scale examples frequently, using models that receive full discussion only later on, to show how macroscopic properties relate to atomic properties. A list of chapter titles does not do justice to the exposition, though it does indicate the approach. Very briefly, the thermodynamics section begins with basic notions—heat, temperature, and pressure—progresses to state variables and the first and second laws of thermodynamics, proceeds to entropy, followed by the thermodynamic potentials. The kinetic theory section starts from notions of probability and distribution functions, proceeds to phase space, transport phenomena, and fluctuations. (The previously brief phase-space chapter was expanded considerably in the new edition, and now gives a vivid picture of how points move in phase space.) The statistical mechanics section takes the information theory approach. It develops the various ensembles—microcanonical, canonical, and grand canonical—and proceeds to the quantum statistics of Bose-Einstein and Fermi-Dirac particles, stopping just short of the Boltzmann H-Theorem and cluster expansions.

This book is not intended as a treatise (it covers fewer specific applications than Landau and Lifshitz's *Statistical Physics*, for example), but it includes many interesting applications and illustrative examples. The new hardbound edition includes several important additions: it introduces entropy parameters and non-equilibrium thermodynamics as part of the discussion of the thermodynamic potentials, and it includes a much lengthier discussion of BE and FD statistics, a section on interparticle forces, and an excellent discussion of the properties of liquid helium. Among the other numerous examples which also appear in the preliminary edition, I might mention the