
Books

Max Planck: Physikalische Abhandlungen und Vorträge. Vol. 1, 776 pp. Vol. 2, 716 pp. Vol. 3, 426 pp. Edited by the Union of German Physical Societies and the Max Planck Society for the Advancement of Science. Friedr. Vieweg & Sohn, Braunschweig, Germany, 1958. DM 150.00 per set. Reviewed by R. Bruce Lindsay, *Brown University*.

These three volumes are published as a memorial to Max Planck, who died on October 4, 1947 at the age of 89. As Max von Laue explains in the preface, it was felt by the German physicists that his memory could be much more appropriately and effectively honored by the republication of his principal scientific papers than by monuments in bronze or stone. The result is indeed an impressive work. All the important scientific papers which appeared in journals from 1879 to 1941 are faithfully reproduced by photomechanical methods to assure that they appear precisely in their original form. These occupy the first two volumes. The third volume contains a selection of Planck's most celebrated general lectures and essays on fundamental problems of physics, a field of communication in which he excelled in clarity and grace of expression. There are also numerous biographical sketches of distinguished physicists, mainly his contemporaries. This includes an interesting autobiography devoted mainly to a review of his scientific life. The volume is concluded with several obituary notices.

Planck of course wrote numerous textbooks and treatises, of which his *Heat Radiation*, *Thermodynamics*, and *Introduction to Theoretical Physics* are best known. Since they are still available in numerous editions no attempt was made to include them in this memorial edition of his works.

Physicists will find these volumes a veritable mine of information on the history of the most important aspects of theoretical physics in the first quarter of the twentieth century. It is thrilling to trace the scientific development of a great genius and particularly pleasurable in the case of an investigator who was able to express his ideas as clearly as Planck and who was rarely content to let the analysis speak for itself. Every major paper has a textual commentary emphasizing the physical ideas involved. To a greater extent than most great scientists Planck took the reader into his confidence with regard to the origin and growth of his scientific ideas. Consequently his papers are worthy of being read and reread as excellent illustrations of the psychology of invention in theoretical physics.

Planck's concern with the most general possible point

of view in physics, as contrasted with emphasis on special details, is well illustrated by his preoccupation with thermodynamics during a large part of his active career. His inaugural dissertation at the University of Munich in 1879 was on the second law of thermodynamics and he approached the whole problem of heat radiation, culminating in his invention of the quantum hypothesis, from the standpoint of thermodynamics. It is not without significance that as late as 1934 he was writing on the principle of Le Chatelier. But the founder of the quantum theory did not follow slavishly any one line of attack on physical problems, and the reader will find in these volumes much attention to most of the contemporary branches of physics including electromagnetic theory, relativity, statistics, atomic structure, and spectroscopy. The principal exceptions would appear to be radioactivity and nuclear physics, which reached an elaborate theoretical stage only toward the end of Planck's active career.

Reading of the papers from 1900 to 1920 highlights the somewhat ironical fact that for years Planck was not happy about the quantum hypothesis in radiation and in a certain sense became reconciled with his own brain child only when its highly successful application to a great number of other physical phenomena left no reasonable doubt of its prime position in modern physics.

Max Planck was an accomplished musician and was devoted to this avocation all his life. Acousticians will be interested to know that hidden away in this formidable array of articles on theoretical physics is a brief description of a demonstration by Planck of a new harmonium before the German Physical Society in 1893!

Physicists throughout the world owe a debt of gratitude to their German colleagues for the appearance of this work.

Proceedings of the Sixth International Conference on Spectroscopy (Amsterdam, May 1956). Edited by W. van Tongeren, F. Freese, E. H. S. van Someren. 663 pp. Pergamon Press, London & New York, 1957. \$25.00. Reviewed by Ralph A. Sawyer, *University of Michigan*.

This supplementary volume of *Spectrochimica Acta* contains the 108 papers (11 in summary form only) presented at the Sixth International Spectroscopical Colloquium which was held May 14-19, 1956 at Amsterdam. The papers from 19 different countries, including several Iron Curtain countries, are written in English, French, or German. Most of the French and German papers include an abstract in English. The papers are followed by brief question-and-answer discussion also in French, English, or German and most of the papers include a bibliography. The Dutch presiding officer presented his opening address in French and his closing address in English.

It is not possible to list all the contributions but the principal areas covered are (1) flame spectroscopy, (2) emission spectrometry, (3) arc emission, (4) spark

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FROM A REVIEW IN *REVIEW OF SCIENTIFIC INSTRUMENTS*

"Altogether the reviewer warmly recommends Dr. Kaplan's book for an advanced undergraduate course in atomic-nuclear structure, for a nuclear physics course slanted for engineering students, and for an introductory one-semester graduate course in nuclear physics (possibly omitting classroom discussion of the chapters on atomic structure)."

609 pp., 186 illus. (1955) \$9.00



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emission, (5) emission (general), (6) instrumentation (emission), (7) instrumentation of absorption methods, (8) ultraviolet absorptiometry, and (9) infrared spectroscopy. The emphasis in all is upon the applications of spectroscopic methods to chemical analysis and taken together they give an excellent picture of the state of the art in this important field of spectroscopy throughout the world. These biennial meetings, of which the seventh was held in Liège in September 1958, constitute the most important opportunity for an international meeting of spectrochemists. It is of interest to note from the literature citations at the end of each article that spectrochemistry recognizes no national boundaries and that most of the articles indicate the familiarity of their authors with the work done in other countries. The volume is well edited and printed and constitutes an important reference work in the field of analytical spectroscopy.

Structure and Evolution of the Stars. By Martin Schwarzschild. 296 pp. Princeton U. Press, Princeton, N. J., 1958. \$6.00. *Reviewed by C. C. Kiess, National Bureau of Standards.*

The life history of a star, including our sun, begins with its genesis in distended nebular matter consisting of dust and meteoric material embedded in gas, chiefly hydrogen. As the nebula shrinks under gravitation, heat is generated and the temperature of the nebula rises from a few degrees above the temperature of interstellar space to one high enough to render the object visible as a red star of large volume, but of low density. Thus a supergiant star has come into being. As the internal temperature rises, through further contraction, there comes a time, not too long after the process started, when the temperature is high enough to bring into play another procedure for generating stellar energy, the transmutation of hydrogen into helium. As this process gains in yield the contraction slows to a halt, while the energy of hydrogen-burning takes over completely the job of maintaining the luminosity of the star and holding its size in balance against the loss of its energy through radiation. At this stage of its career the star will find itself among normal stars of luminosities and spectral classes determined by their masses.

The length of time during which a star is normal depends on the rate at which its internal hydrogen is consumed—faster for massive stars, slower for less massive ones like the sun. But there comes a time when the hydrogen is depleted; contraction sets in again; the temperature rises to a point at which helium-burning can take over the task of keeping up the star's appearance as a normal one. For a while the increase of energy will increase the luminosity of the star, with consequent expansion of its outer layers, and it will take its place among the red giants. Finally, however, when the sources of nuclear energy are exhausted and a series of cataclysmic events occurs, the star will descend to the white-dwarf stage, as one of small vol-

ume, of extremely high density, and of low luminosity, drawing on the thermal energy of its core to keep the spark of life going.

Is all this guesswork? The astronomer cannot dip into a star to get samples of its material for analysis. All he can do is to examine its light with photometer and spectrograph to determine its amount and quality, and then theorize as to the nature of the source. To do this he sets up model stars of assigned mass and composition, and by applying the physical laws relating to gas characteristics he determines the nature of the star's light. And the test of a model is the way it fits into the Hertzsprung-Russell and mass-luminosity relations.

All these matters are discussed in detail in Professor Schwarzschild's book. The first three chapters give the observational data available for the problem, the physical principles governing the behavior of gases at various temperatures and pressures, and the mathematical tools needed for the job. Then come four chapters in which the details are given for setting up and calculating model stellar structures for the initial and subsequent phases of the star's life cycle. In the last chapter the results of the previous chapters are summarized and their bearing on the problem of stellar evolution is described.

This is a good book. It is written in a simple and pleasing style, which at no time leaves the reader in doubt as to what the author is explaining. Mathematical formulae appear on almost every page, yet their physical meaning is explained and the results derived from them are illustrated with diagrams and tabulations. Although written for students of astronomy at the graduate level, the book may be read with profit by a wider group of readers with some preparation and interest in the physical sciences.

Foundations of Modern Physical Science. By Gerald Holton and Duane H. D. Roller. Edited by Duane Roller. 782 pp. Addison-Wesley Publishing Co., Inc., Reading, Mass., 1958. \$8.50. *Reviewed by James MacLachlan, Earl Haig Collegiate Institute.*

"Every Ptolemy is challenged by a Copernicus, every Kepler and Galileo must be made meaningful by a Newton, the insight of every Dalton eventually has to be transposed to a new plane by the work of a Mendeléeff or a Bohr . . . science is an unending quest for wider horizons." The pathways of the quest of physics are opened wide for freshmen in this text by Holton and Roller. An understanding of the developments cited in the quotation is unfolded in an accurate, readable account of physics.

The authors' approach is an effective antidote both to specialized, compartmentalized introductory physics courses and to broad, shallow physical science survey courses. It is all pure physics, though reference is made to aspects of astronomy and chemistry which are required to illuminate the structure of physics. The treatment is unified by the use of historical sequences—