(Society of German Radiation Protection Physicians). Volume 1 of this society's *Yearbook*, which gives the first report on the group's activities, presents topics discussed at the annual meeting of the society, held at Freiburg in January 1961. Cleverly edited by Hans-Joachim Melching and his associates, the volume gives an interesting progress report on the activities in different fields of radiation protection, including radiology in radiation protection, radiation damage incurred as the result of professional activities and its diagnosis, radiation protection laws and their practical application, radiation protection in industry, dosimetry, and problems of waste disposal. There are stimulating contributions by Holthusen, Zuppinger, Heilmeyer, Langendorff, Melching, Wideroe, and Sommermeyer—just to mention a few that are worthy of study. I found especially interesting the article by Umberto Cocchi, "Professional radiation damage in man," which presents valuable information (in both text and illustrations) on the early historical development of radiation protection measures.

The yearbook reflects well the activity of the society during 1961, activity which apparently inspired not only more systematic studies but also the participation of many outstanding scientists in the society's second meeting, which was held in January 1962. According to the announcement, volume 2 of the yearbook will present important contributions by Langendorff, Buu-Hoi, Faber, Mitchel, Bacq, Maisin, and other well-known scientists.

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For Engineering Students

Handbook of Vector and Polyadic Analysis. T. B. Drew. Reinhold, New York, 1961. vii + 103 pp. $5.50.

Drew begins by giving the standard treatment of vector algebra which one expects to find in a book for engineers and physicists. Then he goes on to discuss Gibbs's algebra of dyads, using the Gibbsian notation, and finally proceeds to a generalization of it called polyadic algebra. The various differential operators are defined, and their algebraic properties are developed. Integral formulas are nowhere mentioned.

The author states that the material is intended for the use of engineering graduate students in fluid mechanics, heat transmission, and diffusion. Unfortunately, formulas expressed in the notation of this book will be incomprehensible to most mathematicians and physicists, and I feel that it would be regrettable for students of engineering to learn it rather than the standard notation of Levi-Civita and Einstein or the more modern notation of the exterior differential calculus of E. Cartan, which is now finding its way into undergraduate courses on advanced calculus and applied mathematics.

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Wordy Labyrinth

Atlas of the Universe. B. Ernst and T. E. de Vries. H. E. Butler, Ed. Nelson, New York, 1961. 227 pp. Illus. $9.95.

This book, which was written in Holland by "non-specialists for non-specialists" to present the "picture of the universe developed by modern astronomy," consists of a series of photographs and illustrations and a short encyclopedia of astronomy.

Photographs presented in the usual order, starting with the earth and proceeding out to the universe of galaxies, constitute about one half of the book. The authors have assembled a fine collection of photographs and drawings, many of which are not usually seen in popular books and the reproduction is usually good, although some lack the contrast needed to bring out fine details. In this section the authors have crowded too much material into the text accompanying the photographs, for the text is a highly condensed survey and history of astronomy. For example, the caption accompanying the photographs of the Andromeda galaxy traces the history of the island universe theory from Wright and Kant up through Hubble. It includes the observations of Herschel (on star clusters), and Huggins (on gaseous nebulae), the problem raised by the supernova of 1885, and the solution of that problem by Hubble, using Cepheid variable stars. But no mention is made of how Cepheid variables can be used to determine distances! The nonspecialist certainly does not have the background to assimilate all of these details.

A better level is achieved in the second portion, which contains some good short discussions on subjects ranging from aberrations to zodiacal light. There are also numerous tables with useful astronomical information. But again the authors show lack of perspective when they give only a small discussion of the important topic of stellar evolution but include such things as zero velocity surfaces and Lagrangean points in a discussion of spectroscopic binaries.

The book will be of value to a high school student interested in astronomy or to an amateur who wants a ready reference together with some good photographs. Both should use the book with care, however, since there are many errors scattered throughout. The general reader who wants to learn about astronomy will get little from the book. He will find the first section too condensed and confusing for his purposes, while the second is useful only for reference.

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The Peacock Memoir

X-Ray Powder Data for Ore Minerals. The Peacock Atlas. L. G. Berry and R. M. Thompson. Geological Society of America, New York, 1962. vi + 281 pp. Illus. $8.25; GSA members, $6.

This excellent memoir is largely a collection of tabulated records of photographic x-ray powder diffraction patterns of ore minerals. Bragg angles, observed and calculated spacings, intensities, and indices are listed for the lines of each of the almost 300 patterns reported. Nearly all native metals, sulfides, sulfosalts, opaque oxide minerals, silver and mercury halides, calcite, dolomite, minerals of the wolframite and scheelite groups, and quartz are represented by these patterns. All of them were produced in the laboratories of the authors or in the laboratory of the late M. A. Peacock under whose direction the work was begun.

The tabulations are most complete.

For scheelite, for instance, 67 lines are listed, the first 35 being crystallographically indexed. Cell dimensions are given for most materials, many new determinations being reported, together with useful notes on previous work, literature references, and a brief statement regarding the crystal structure when known. Localities are given for all specimens examined. In many cases specimens from a number of localities have been examined—for instance, jordanite from seven localities and boulangerite from about 35 (!) localities. There are alphabetical and chemical indexes of mineral species, a locality index, and an index of strongest powder lines arranged in the manner of the index to the "X-ray Powder Data File" of the American Society for Testing Materials. All of the patterns, as recorded in cylindrical cameras of 57.3 cm diameter, are clearly reproduced in their original size on 27 plates.

This is undoubtedly the finest compilation of x-ray powder diffraction data that has been published; the atlas fully meets the exacting standards of its originator, for whom it is named. It should be in the hands of all who use x-ray diffraction in the examination of ore minerals or related materials.

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Archeological Enigma

The Great Kivas of Chaco Canyon and Their Relationships. Gordon Vivian and Paul Reiter. The School of American Research and the Museum of New Mexico, Santa Fe, 1960. v + 112 pp. Illus.

Great kivas are a type of oversized, mostly subterranean, socioreligious structure that originated back in Basket Maker times and, presumably, attained their fullest development late in the 12th century A.D. Those of the Chaco Canyon National Monument in New Mexico—of which seven have been excavated according to these authors—are among the best, architecturally.

The Great Kiva is an architectural achievement. Varying in diameter from 30 to 80 feet, with walls built of sandstone and mud, its roof supported upon four pillars of wood or stone or a combination of both, a raised firebox midway between the southern pillars, and masonry "vaults" (of unknown function) between pillars on either side, the Great Kiva remains an archeological enigma. No one really knows the part it played in prehistoric Pueblo society, and no one, including the present authors, can resist speculation. The paired vaults on either side, the raised firebox, deflector, and other features may or may not have their counterparts in the ceremonial chambers of living Pueblo Indians, but they do spur the imagination and tempt comparison with similar features in standard kivas of the area.

Nineteen excavated examples are cited by the authors—seven in Chaco Canyon National Monument, one on Mesa Verde National Park, and the remainder widely distributed—but not all archeologists will agree with the authors' identifications as Great Kivas. All of the kivas have the features named above; some, but not all, possess an encircling bench or perhaps two benches, one above the other; some, but not all, have a raised antechamber at the north, reached by recessed steps; some have a series of niches, of uniform size and above-bench-height in the wall, and a few are surrounded by peripheral rooms. But it is the diameter of the Great Kiva and the manner of supporting its huge roof that has awakened most interest, not only on the part of archeologists but also on the part of present-day architects. Invariably each excavated example retains vestiges of four pillars; sometimes these are posts, two feet in diameter, seated subfloor upon sandstone disks, sometimes squares of masonry built upon flagstones. The authors speculate (and admit it is speculation) that, whatever their height, these four pillars supported a roof—of logs, lesser timbers, split cedar, and mud—the total weight of which would challenge a modern engineer. Only one estimate has been made, that for the Great Kiva at Aztec National Monument, and here total weight is estimated at 90 to 95 tons.

Vivian and Reiter summarize available data relative to the Great Kiva, suggest its origin and development, and offer comparison with lesser structures still in use. They have presented a study of much interest and value to their fellow archeologists, but the minutia of description will repel all others.

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Probability Theory

Random Processes. M. Rosenblatt. Oxford University Press, New York, 1962. x + 208 pp. $6.

Until the early 1930's probability theory was frankly directed toward the solution of problems in statistics, economics, and the physical sciences. The application of measure theory to the foundations of the subject, as well as the more detailed investigations of the central limit theorem by the French school, has projected probability theory into a respectable subject for study by pure mathematicians. This outlook on probability theory is perhaps best epitomized by the books of Doob and Loeve. The present volume by Rosenblatt is also devoted to the pure rather than to the applied aspects of probability. It is far less comprehensive than the aforementioned books, but this is hardly a shortcoming since it is supposed to be a text for advanced undergraduates or beginning graduate students.

As an expository volume on theoretical probability this book is to be highly recommended. However, I doubt that it will be satisfactory as an introductory text because there is very little to motivate study of the topics Rosenblatt has chosen for discussion. The proofs are frequently elegant, but elegance is not necessarily good pedagogy. For example, a form of the central limit theorem is proved by Petrovsky's method, which uses upper and lower functions. The proof is an extremely ingenious one, but it cannot be used to find correction terms, nor is it direct enough to show exactly where the hypotheses are important. On the other hand, the treatment of the theory of Markov chains, a high spot of the book, is clear, simple, and elegant; it makes extensive use of Frobenius' theory. Existence and uniqueness theorems are provided for the equations describing continuous Markov processes. Other topics worthy of specific mention include ergodic theory and random harmonic analysis.

This book is an excellent and useful addition to one's library, but because of its lack of contact with applications, it is not suitable for an introductory course in probability.

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