British Space Research

Space Physics. Harrie Massey. Cambridge University Press, New York, 1946. viii + 237 pp. Illus. Paper, $2.95; cloth, $6.50.

The appearance of a book on space physics written by a single author is a welcome addition to the literature of symposium reports and collections of specialized articles, for it allows, perhaps paradoxically, a much broader treatment of the subject. And Sir Harrie Massey, who is well known for his work in atomic physics and upper-atmospheric studies, and who is presently chairman of the British National Committee for Space Research is well qualified to write such a book. In nine chapters, Sir Harrie covers a range of topics from the operation of p-n junction solar cells and the theory of orbits in a gravitational field, through the nature of the upper atmosphere, to the emissions of the sun, moon, and planets. These topics are not by any means treated in the same detail, however, and the author's experience and interest are very clearly indicated in the quality of the presentations. The chapter that deals with the orbits of satellites in a gravitational field, and the determination of the figure of the earth and atmospheric density from them, is excellent. (There is no corresponding discussion of the gravitational and other torques on the satellite.) But the best chapters are the three that discuss the upper atmosphere and ionosphere; these chapters proceed logically and historically from a discussion of what has been learned, and how, by earthbound techniques to the solution of some of the problems, and the posing of new ones, by rocket and satellite observations. The instrumentation of the British satellite Ariel is quite thoroughly discussed, and many results of its observations are presented. (The book is based on a set of lectures that Sir Harrie presented at the Cavendish Laboratory, Cambridge, in November 1962, so that many of the results are preliminary.) These sections can be recommended to nonspecialists as among the best available summaries.

Once above the ionosphere however, the discussion is less thorough, even perfunctory. There is a discussion of the theory of particle trapping and of observations of the radiation belts, which touches on most of the essential topics, but which also leaves a great deal unsaid about them. In the last chapter, on lunar and planetary research, the properties of these objects are presented as so many numbers to be collected, without much discussion of their significance for the history of the universe.

There are no references, which means that the book cannot be very useful as an introduction to additional and more specialized study, a very unfortunate lack.

PAUL J. KELLOGG
Institute of Technology,
School of Physics and Astronomy,
University of Minnesota, Minneapolis

Mathematics

Periodic Differential Equations. An introduction to Mathieu, Lamé, and allied functions. F. M. Arscott. Pergamon, London; Macmillan, New York, 1964. x + 281 pp. Illus. $9.50.

This book is concerned with the construction and analysis of a half-dozen special functions that are of importance in mathematical physics. These functions emerge, on the separation of the reduced wave equation (Helmholtz equation) into ordinary differential equations relative to various coordinate systems. Thus, they share the common heritage of being solutions of linear, ordinary, second-order differential equations with simply or doubly periodic coefficients. The treatment is rigorous and lively, and the author has successfully avoided the handbook flavor that is typical of many works on special functions. There is a substantial amount of interesting and serious analysis permeating the development of these functions, and both the student and the specialist should find the study of this book a stimulating experience.

Following an introductory chapter, which divulges the common source of the differential equations and the overriding importance of the special periodic solutions to be considered, there are five chapters (almost one-half of the book) that cover the familiar Mathieu equation. Though the general Floquet theory is presented, the analysis is concerned mainly with the construction and the study of the periodic solutions (Mathieu Functions). The treatment is fairly extensive and thorough, and includes the continued fraction expansions and the asymptotic expansions. The author has suggested that his treatment is intermediate between that of McLachlan's *Theory and Applications of Mathieu Functions*, written primarily for engineers, on the one hand, and Meixner and Schäfke's *Mathieusche Funktionen und Sphäroidfunktionen*, which rests on a fairly deep Banach space foundation, on the other.

There is a brief chapter on Hill's equation and the special Whittaker-Hill-Ince equation with three terms and a relatively long chapter on the spheroidal wave equation. Equations with doubly periodic coefficients are represented by Lamé's equation and the ellipsoidal wave equation. For the former, the Lamé polynomials as well as simply periodic solutions are constructed, while for the latter only the doubly periodic ellipsoidal wave functions are considered. No general techniques are available for constructing solutions of the ellipsoidal wave equation, and so the author has considered special cases and perturbational solutions.

R. A. STRUBLE
Department of Mathematics,
North Carolina State University,
Raleigh

Canberra Symposium

Water Resources, Use, and Management. Proceedings of a symposium held at Canberra in September 1963. Edwin S. Hill, Ed. Melbourne University Press, London; Cambridge University Press, New York, 1964. x + 529 pp. Illus. $35.

This book is a compilation of 40 papers and discussions presented at the National Symposium on Water Resources, Use, and Management, which was sponsored by the Australian Academy of Sciences in Canberra, 9 to 13 September 1963. The symposium brought together experts and specialists in various aspects of water development, measurement, use, and management to discuss the current status of hydrologic information, analysis techniques, and research needs. With three exceptions, all of the contributors were Australians. R. K. Linsley and W. B. Langbein of the United States and V. N. Kunin of the U.S.S.R. presented papers by invitation.