Time, knowledge, and the nebulae: an introduction to the meanings of time in physics, astronomy, and philosophy, and the relativities of Einstein and of Milne. Martin Johnson. New York: Dover, 1947. Pp. 189. $2.75.

Milne's Kinematical Relativity, which is derived from definitions of distance and time in terms of simultaneity and succession at the observer, was first published some 15 years ago. It is considered by many (including Dr. Johnson) to be as great a philosophical advance as Einstein's Relativity of 1904 or Newton's Laws of Motion.

In this little book Dr. Johnson presents in readable form a survey of various relativities and cosmologies together with their philosophical implications. Two basic themes are developed. The first concerns the nature of time, this leading to a rejection of causality in favor of "functional dependences," and to a critical examination of the various contexts in which "time" is used. The second and more important theme has to do with the *Principle of Communicability*, proposed by Johnson as the philosophical basis of all science. On this principle, the relativity transformations and time scales of Milne are shown to be necessary in order that experience (*i.e.* the Laws of Physics) may be communicated intelligibly from one observer to another.

Many scientists will want to bring themselves up to date on relativity and the changing philosophy of science by reading this excellent work. Nonmathematical readers will find most of the mathematics easy to follow, although the addition of simple space-time diagrams would have been an immense help to the uninitiated reader. It is unfortunate, too, that there is scarcely mention of geological time, of time in evolution, or of accelerated reference systems. The spiral form and the red-shifts of the spiral nebulae are discussed fully, but the significance of Hubble's surveys determining density distribution is ignored.

Time, knowledge, and the nebulae should stimulate further research among astronomers and physicists by pointing to new possibilities in the interpretation of data. As Prof. Milne says in the forward: "... only ... through the consideration of the problem of time, can the important questions of physics be properly investigated."

THORNTON PAGE

Yerkes Observatory, Williams Bay, Wisconsin

Methods of mathematical physics. Harold and Bertha Swirles Jeffreys. Cambridge, Engl.: at the Univ. Press, 1946. Pp. vii + 679. $15.00.

The authors preface their large Cambridge volume with the statement: "This book is intended to provide an account of those parts of pure mathematics that are most frequently needed in physics." This they have done by giving an account of fairly extensive topics, principally in analysis beyond the calculus, and by then applying methods developed therefrom to selected problems in physics. The consequence is a most useful compendium of special methods and results, rich in problems but somewhat lacking in general points of view which would tie the material treated into a more unified whole.

In developing the more purely mathematical topics the authors have been guided by the sound principle that high standards of rigor are as necessary for applicable as for pure mathematics; it is recognized that in order to achieve such rigor without un-

due complications some sacrifice of generality must be made. Thus, in proving theorems in real and complex variable, conditions are postulated which are sufficiently broad to cover the proposed applications, and the theorems are then proved with the rigor appropriate to the subject; the authors are justifiably less concerned with whether the conditions postulated are necessary for the truth of the theorem. In this spirit an admirable exposition is made of series, integration, calculus of variations, conformal mapping, linear differential equations, and a host of other topics. The chapters on vectors, tensors, matrices, and operators present and apply a wealth of useful results, but it seems to the present reviewer that their treatment from a more fundamental algebraic point of view would lead to a deeper understanding, both of the topics in themselves and of their role in modern physics.

The physical fields to which the mathematics is applied are almost as broad as physics itself—including, as they do, dynamics, hydrodynamics, elasticity, and electromagnetism, among others. It is to be observed that these applications are to specific topics in these fields and that a fuller appreciation of their significance requires some previous familiarity with the fields. Perhaps the greatest lacuna is the quantum theory, which is touched upon altogether too lightly in view of its importance in modern physics and astrophysics, and which offers an excellent opportunity to draw together several fields under a unified mathematical viewpoint.

Altogether the book offers a wealth of well-treated material which should prove most useful as a source or reference for students, teachers, and advanced workers in physical science. It is a source of gratification to note that physically and typographically the Cambridge University Press has here done a job which is well up to their high prewar standards.

H. P. ROBERTSON

California Institute of Technology

The Soochow astronomical chart. W. Carl Rufus and Hsing-Chih Tien. Ann Arbor: Univ. Michigan Press, 1945. Pp. 24. (Illustrated.)

In the Wên Miao temple near Soochow, Kiangsu, China, there is a star map, about three feet in diameter, accompanied by a text prepared in 1193, engraved in stone in 1247. Eduard Chavannes published, in 1913, a reproduction of the chart, with a French translation of the text, but without an identification of the asterisms and stars or a translation of their names ("L'Instruction d'un futur empereur de Chine en l'an 1193, Carte astronomique," *Acad. Inscr. Belles-Lettres, Mém. Asie orientale*, 1913, 1, 43–57). The present publication offers, in addition to a good reproduction of the star map and of the accompanying text, an introduction, a description of the star map, an annotated translation of the text, and tables of 313 asterisms and 1,440 stars, with their names and, when feasible, their identification.

The text of the "instructions for a future emperor" is a blend of cosmography and political astrology. The star map has the North Pole in the center; the three concentric circles mark the circumpolar asterisms (ca. 35°, latitude of Kai-Feng Fu, Honan, seat of the Government, 1214–67), the equator, and the limit of southern asterisms (ca. −55°). The 28 lunar mansions —of unequal extent—are shown by radial lines extending from

the circumpolar circle to the rim of the map. The ecliptic has an obliquity of about 24°. The Milky Way (The River of Heaven) is outlined. The purpose of the map is primarily astrological; the identification of many stars shown on it is a hopeless task.

This publication is a companion work to "A Korean star map," by W. Carl Rufus and Celia Chao (*Isis*, 1944, 35, 316–326).

ALEXANDER POGO

Carnegie Institution of Washington

The earth and the stars. C. G. Abbot. New York: D. Van Nostrand, 1946. Pp. xii + 288. (Illustrated.) $3.75.

This book by Dr. Abbot is like a tour in the universe of space and time with a guide who is enthusiastic and optimistic and has an interest in people as well as in stars. The author impresses the reader not only with the vastness of the universe, but with its beauty, its unsolved problems, and the significance of intelligent life.

The material of the 1926 edition has been rearranged, some has been omitted, and much new has been added. The print is larger and the paper better. A few inadvertent slips have been noted which could be corrected by a sheet of errata inserted by the publisher in each copy of the book. Plates referred to in the text as XIII, XX, and XXII are missing; plates of different subjects bear those numbers.

The author begins with descriptions of appearances. Then he explains interpretations given them, from ancient myths to results obtained with modern equipment. Two chapters on the sun include a discussion of the sun's periodicities, their influence on weather, and the possibility of utilizing the power in solar radiation. So modest is the treatment of Dr. Abbot's own part in these researches that the reader would not realize how large it is. Topics related to astronomy, such as atoms, calendars, star places, and navigation, are explained. In the last chapter, "Some Famous Astronomers and Famous Instruments," are described feelingly the high lights of astronomical history from Hipparchus to the construction of the 200-inch telescope. Appendixes contain astronomical tables, a brief explanation of tides, a glossary, and an index.

LEAH B. ALLEN

Hood College, Frederick, Maryland

Making your own telescope. Allyn J. Thompson. Cambridge, Mass.: Sky, 1947. Pp. xi + 211. (Illustrated.) $3.50.

This volume contains a reasonably consecutive set of directions for the construction of a reflecting telescope of 6-inch aperture and 48-inch focal length. After a brief account of the discovery and development of the telescope, the author gives a list of the materials and equipment needed to make the telescope mentioned above, and proceeds to tell how to grind the mirror, prepare a pitch lap, and polish and figure the mirror. He describes the making of a diagonal mirror, but limits himself to the description of three common types of eyepieces, Huyghenian, Ramsden, and Kellner, referring the reader to other books for complete details on their construction.

Plans are given for two equatorial mountings made from standard pipe fittings. In the chapter "Aluminizing and Cleaning," the author assumes that the telescope maker will send his mirror away to be aluminized and says only that "instructions for silvering by the Brashear and other processes may be found in optics, telescope making and physics laboratory texts."

Mr. Thompson has served as an instructor in telescope-making classes at the Hayden Planetarium in New York City; his book indicates that he has met most of the problems encountered by amateurs. Many of the solutions proposed are the standard ones, tried and proven by several decades of American amateur telescope makers. Considering how often the mirror and tool stick together for an unskilled amateur, the author's suggestion, "If this occurs, use a carpenter's wooden clamps to separate them, or wedge the tool on a bench, hold a block of wood against the side of the mirror, and free it with a sharp blow of the hammer," seems like powerful medicine. A little more emphasis on prevention and one or two less drastic cures would make worthwhile additions to the book.

The author appears to be optimistic about polishing (2–6 hours, p. 67) and needlessly pessimistic about figuring (15–25 hours, p. 196). When the testing of three nearly-plane surfaces against each other is discussed (p. 102), no mention is made of 'saddle-shaped' surfaces, which are common in small sections of plate glass; no clue is given as to what may be done with them. Other small omissions are noted, but a second edition will doubtless take care of them in due time.

As it is, the book is an excellent one for the man who is making his first reflecting telescope.

CHARLES H. SMILEY

Ladd Observatory, Providence, Rhode Island

Scientific Book Register

FEDERER, CHARLES, and FEDERER, HELEN. *Splendors of the sky.* (2nd ed. rev.) Cambridge, Mass.: Sky, 1947. Pp. 36. (Illustrated.) $.35.

GAMOW, GEORGE. *Atomic energy in cosmic and human life: fifty years of radioactivity.* Cambridge, Engl.: at the Univ. Press; New York: Macmillan, 1947. Pp. x + 161. (Illustrated.) $3.00.

JONES, HAROLD SPENCER. *John Couch Adams and the discovery of Neptune.* Cambridge, Engl.: at the Univ. Press; New York: Macmillan, 1947. Pp. 43. $.75.

LEY, WILLY. *Rockets and space travel: the future of flight beyond the stratosphere.* New York: Viking, 1947. Pp. viii + 374. (Illustrated.) $3.75.

SPURR, J. E. *Features of the moon.* Pt. I: *Geology applied to selenology; the Imbrian Plain region of the moon.* Pt. II: *The features of the moon.* Lancaster, Pa.: Science Press, 1945. Pp. x + 112 (Pt. I); xiii + 318 (Pt. II). (Illustrated.) $5.00.

STERNS, MABEL. (Compiler.) *Directory of astronomical observatories in the United States.* Ann Arbor, Mich.: J. W. Edwards, 1947. Pp. x + 162. (Illustrated.) $2.85.

————. *Harvard College Observatory, the first century: a review of the past and a preview of the future.* Cambridge, Mass.: Harvard College Observatory, 1946. Pp. 94. (Illustrated) $1.00.