Book Reviews

Mesons and Fields. vol. II, *Mesons.* Hans A. Bethe and Frederic de Hoffmann. Row, Peterson, Evanston, Ill. 1955. xiii + 446 pp. Illus. $8.

Mesons is the second volume of a two-volume set on the general subject of high-energy physics. Volume I, which has not yet been published, is devoted primarily to modern quantum field theory, whereas volume II is concerned largely with meson physics, and in fact, mostly with π-meson physics.

These books are the outgrowth of a series of lectures given by Bethe at Cornell University to an audience containing a good fraction of experimental physicists. As a result, a great deal of space is devoted to the analysis of experimental data in terms of fundamental theoretical parameters. This is an aspect of physics that is frequently shunned by "pure" theoreticians and its appearance will warm the hearts of experimentalists.

The first two chapters of the book describe the experiments that have uncovered the fundamental character of π-mesons—for example, spin, parity, mass, and so forth. Following an introductory survey of the experimental data, the subject of pion-nucleon scattering is taken up in earnest. The ideas of charge independence and the formalism of isotopic spin as applied to this problem are presented with great clarity. The analysis of scattering data in terms of phase shifts is treated in great detail, and all experimental data are closely scrutinized. The next major topic is the photoproduction of pions, where again the experimental data are gleaned from all information and translated into a form suitable for comparison with theory.

After a brief historical review of meson theory, the general theory of the Tamm-Dancoff method is developed in great detail and applied to a calculation of pion scattering on the basis of pseudoscalar meson theory. Various theories of photomeson production are described and compared with experiment.

A short discussion is given of several theoretical attempts at calculating nuclear force from meson theory. The theory of meson production is treated primarily phenomenologically. The book ends with a summary of the most important experimental facts and theoretical conjectures about μ-mesons and curious particles.

There is one feature of the book that may cause difficulty for beginners and that is the fact that very many theoretical calculations are described for a given process even when some of the treatments are quite contradictory. The authors have not chosen to be arbitrators. The dilemma that faced them was not of their own making: it has proved singularly difficult to extract reliable information from meson theory and a decision in favor of any given calculation is at the present time often hard to reach. Despite this difficulty, *Mesons* fills an important need and will be of great value to students and research workers.

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Astronomical Cuneiform Texts. vol. I, *Introduction: The Moon.* vol. II, *The Planets.* vol. III, *Plates.* O. Neugebauer, Ed. Lund Humphries, London, 1955. vol. I: xvi + 278 pp. Illus. vol. II: xii + 233 pp. Illus. vol. III: 255 pp. Plates. £5 5s. per set.

Conventional accounts of the development of the physical sciences are likely to begin with the creation of science in ancient Greece (the "miracle" of Greek science) and then skip to Galileo and his age (when "modern science" was "invented"). Research in the history of the exact sciences has been filling in two major gaps, the interval between the decline of ancient science and the age of Galileo, and the long ages before the Greek philosophers supposedly invented science. In recent decades, the heroic labors of O. Neugebauer and his associates have unveiled the pre-Greek history of mathematics and astronomy. We now know that many Greek discoveries, such as the Pythagorean theorem and the theorem of Thales that an angle inscribed in a semicircle is a right angle, were known long, long before to the Babylonians. Neugebauer, conscious of the scholarly tradition of which he is the greatest luminary, dedicates the present work to three Jesuit fathers who pioneered the study of Babylonian astronomy, J. N. Strassmaier, J. Epping, and F. X. Kugler.

The present work is based on some 300 clay tablets and fragments that were excavated in Mesopotamia and are now to be found in museums in Istanbul, Paris, London, Berlin, and America. These tablets contain ephemerides for the sun, moon, and planets, or computational procedures. Each table is transcribed in the now standard adaptation of Hindu-Arabic numerals to the sexagesimal notation of the Babylonians; for the scholar there are photographs and drawings of tablets. These astronomical tablets date from the Seleucid period, roughly coeval with Greek mathematical astronomy, and are much later than the mathematical tablets.

Although it was not Neugebauer's intention to write a history or descriptive account of Babylonian astronomy, the "general introduction" to each section and the discussions of each of the texts enable the reader to follow the main outlines of the subject. The primary object of the Babylonian theory of the planets proves to have been the determination of the time and longitude of consecutive "characteristic phenomena," such as the first and last visibilities and stationary points in the east and west for the inferior planets and the first visibility in the east, first stationary point, opposition, second stationary point, and last visibility in the west for the superior planets. This is quite different from the aims of Ptolemy's astronomy, in which the goal was to find the geocentric latitude (and longitude if needed) of any planet at any given time.

Neugebauer points out that this difference has a bearing on astrology in that the "characteristic phenomena" in the Babylonian ephemerides "play no role whatsoever in astrological practice." The position of the planets in the zodiacal sign at date of birth, which is of primary interest to the astrologer, can be found by the Ptolemaic methods, but this type of problem "is *not* immediately solvable from the ordinary Babylonian ephemerides." Neugebauer says: "The Babylonian approach is obviously the 'natural' one. What one realizes first about the planets is their appearance and disappearance in the nightly sky, their stations and retrogradations. To predict these phenomena seems to be the real problem and it was solved by our texts by means of very ingenious arithmetical devices. But it marks an enormous step forward to ignore the 'natural' problems altogether and to ask an apparently much more complex question: how to describe the planetary motion as a whole. It is this shift of emphasis which led Apollonius, Hipparchus, and Ptolemy to their enormous successes."