Planets and Satellites. Vol. 3 of The Solar System. Gerard P. Kuiper and Barbara M. Middlehurst, eds. 601 pp. University of Chicago Press, Chicago, Ill., 1961. $12.50. *Reviewed by E. J. Öpik, University of Maryland.*

THE editors and authors are to be congratulated for producing a volume of such complete and authentic basic information on the members of the solar system. The outer appearance, motions, internal and atmospheric structure, photometric and radiative properties of the planets and their satellites are covered in eighteen chapters which were contributed by outstanding competent authors; encyclopedic completeness of the topics is matched by the lucidity of presentation, up-to-date observational material and interpretations which are partly new, luxurious illustrations, and an extensive bibliography.

The backbone of the volume is formed by three fundamental contributions: Orbits and Masses of Planets and Satellites, by Dirk Brouwer and G. M. Clemence; The Stability of the Solar System, by Yusuke Hagihara; and Planetary Interiors, by Rupert Wildt. Besides fundamental information, from these we learn, for example, that "at present no reliable gravitational determination of the mass of Pluto is available"; that the oblateness of Jupiter and Saturn, as determined dynamically from the secular motion of the nodes and apsides of their satellites, essentially confirms the solid-hydrogen models for their internal structure; that the orbits of the planets may remain stable for up to 10^{11} years, but that mathematical methods fail to prove or disprove it; that our knowledge of the internal structure of the planets is on a sound basis, two main types of structure occurring: the terrestrial, dense and composed of silicates and iron, and the Jovian, of low density and mainly consisting of solid hydrogen and helium.

Four chapters deal with surface detail of the planets. The introductory chapter of the volume, by S. Fritz and H. Wexler, discusses our own globe as seen from space, on the basis of photographs taken with the TIROS I weather satellite in 1960; 22 plates containing 41 pictures serve as illustrations. In another, A. Dollfus surveys visual and photographic observations of planets and satellites, made at the favorably located and well equipped Pic du Midi Observatory, with 45 plates and a much greater number of single images; the technique of composite photographs is partly applied. M. L. Humason publishes 15 plates of photographs of Saturn, Venus, Mars, and Jupiter, taken with the 200-inch telescope of Mount Palomar, partly in red and blue light. W. S. Finsen presents, as a surprise, 10 color photographs and 5 ordinary photographs of Mars, obtained at the Union Observatory, Johannesburg, South Africa.

Specially astrophysical topics are thoroughly covered in nine chapters forming the heart and core of the volume: a complete review by M. Minnaert of observational and theoretical work on the photometry of the Moon; a specialized treatise on the photometry of lunar eclipses by D. Barbier; an extended review by D. L. Harris of all available data on the photometry and colorimetry of the planets and their satellites; polarization studies of the planets, by A. Dollfus; two separate contributions, by Edison Pettit, and by W. M. Sinton, on radiometric studies and temperature determinations of the planets and the Moon; a beautifully presented discussion of the radio emissions and radio temperatures of the planets, by C. H. Mayer; two competing articles on radio observations of Jupiter, by B. F. Burke and by R. M. Gallet (the one by Burke, unfortunately, contains many misprints in the formulae). There is an account of the search for a trans-Neptunian planet by C. W. Tombaugh, which led to the discovery of Pluto. The volume concludes with a discussion by G. P. Kuiper of the limits of completeness of our knowledge of the satellites (with 12 plates). The author has arranged special searches and, on the basis of his experience, concludes, e.g., that Venus cannot have a distant satellite exceeding 5 km in diameter, or a very close satellite of more than 12 km; for Mars the size limit of undiscovered satellites is 1.4 km, an order of magnitude smaller than its two known satellites.

In a volume of this size, some misprints and misstatements are unavoidable; their number, however, is small, and usually they are obvious and do not interfere with the understanding of the text.

The volume is an indispensable handbook for all astronomers, space scientists, physicists, and others dealing with the astronomical and physical properties of the members of the solar system.

Nonlinear Oscillations. By Nicholas Minorsky. 714 pp. D. Van Nostrand Co., Inc., Princeton, N. J., 1962. $16.75. *Reviewed by T. Teichmann, General Atomic Division, General Dynamics Corp.*

IN the years since the publication of Minorsky's well-known Taylor Model Basin report, there has been a tremendous growth of interest in nonlinear mechanics, stimulated largely by applications, but by no means restricted thereto. There has also been an accompanying increase in the number of books and publications, but these have generally restricted themselves to several important aspects of the subject (e.g., stability) and have tended to treat either the examples in a laconic, or the theory in a cavalier manner. This new review by Minorsky covers almost all aspects of the underlying mathematical theories in a comprehensive and perspicuous manner, and discusses numerous important examples in a helpful and adequately detailed way.

After dealing with "qualitative" aspects of the theory (topology, geometry, and stability), which incidentally can yield quite a bit of numerical information about characteristics of a nonlinear system, if not about the detailed motion itself, the author gives a description of the various quantitative methods, including both the standard ones (averaging, linearization, asymptotic and perturbation expansions), and the more modern techniques of stroboscopic analysis and the use of Nyquist diagrams. These methods are then applied to a variety