matter and form of presentation, he cannot help enjoying the clearness, consistency, and cogency with which the author presents his case from cover to cover.

KURT LAVES.

Cours d'Astronomie. Première Partie: Astronomie théorique. By H. ANDOYER. Paris, Librairie Scientifique A. Hermann, 1906. 222 pp.

AFTER a rather prolonged lull in the publication of text-books on spherical and practical astronomy we are now about to to receive from the press two treatises on the same subject, the one by Professor W. Foerster, the former eminent director of the observatory of Berlin, the other by Professor Andoyer, the well-known scholar of the Paris observatory. The first parts of both treatises have just left the press. A review of Professor Foerster's book has been published in the *Astrophysical Journal.* In giving a short outline of Professer Andoyer's book in a journal devoted to mathematical science, an effort is made to bring out those points primarly which are of interest to mathematicians. Chauvenet's two large volumes on spherical astronomy are too voluminous to lend themselves easily to the needs of a mathematician who tries to inform himself about the application made in astronomy of a certain mathematical theorem he is interested in. Andoyer's book is much more adapted for such purposes. After an introductory chapter concerning spherical trigonometry and a short deviation into spheroidal trigonometry to the extent to which this is needed for elementary geodesic questions, the author gives in the next seven chapters a rather condensed account of refraction, parallax and aberration. Before the theory of precession and nutation is taken up, the reader is initiated in Chapter IX into the more elementary notions of celestial mechanics. This is necessary since the apparent position of a planet, after it has been corrected for refraction, parallax, and aberration, will yet have to be freed from the disturbing influences of the neighboring bodies. To quote but one example: in the definition of apparent solar time, the center of the earth is pulled out of its elliptic path by the various members of the solar system. These perturbations of the individual members must be brought into tables so that for a given value of the time the amount of pull due to each individual member can be properly added to the position of the earth in the elliptic path. Now since the

apparent solar time is measured in the ecliptic, from the point of vernal equinox, *i. e.*, the point where the equator and the ecliptic of a time intersect each other in springtime, it is obvious that the perturbing influence of surrounding matter on the oblate earth is to affect the positions of the planes of reference: equator and ecliptic. These changes are comprised under the name of precession and nutation. In the ninth chapter a short discussion is found concerning the convergence of series used in astronomy. It is the only place in the book where a knowledge beyond the differential and integral calculus is needed. Chapter X is devoted to precession and nutation and formulas are derived for the equatorial and elliptic coordinates to correct the position of an object for the secular and periodic changes in the position of the planes of reference. It would seem as if by the study of the polar triangles the author might have accomplished his result even more successfully, thus keeping the distinction between planetary and luni-solar precession clearly before the eyes of the reader.

The last chapters of the book deal with the geocentric motions of the sun, moon, planets and their satellites. Here the eccentricities and inclinations are assumed to be zero to simplify the deductions. An elementary exposition of the theory of eclipses of moon and sun and of the occultation of stars by the moon finally ends this first part of Professor Andoyer's treatise.

It is perhaps not out of place to point to the great wealth of problems that the subject matter of spherical astronomy affords. In doing so it is but necessary to state in its most general aspect the problem that this science aims to solve: An observer O is located on the surface of a rotating spheroid (earth) the center of which revolves in a well defined manner about the center of gravity of the solar system. A ray of light emanating at the time t_0 from a movable point P (a planet) passes through the atmosphere of the earth and reaches the retina of the observer at the time t_1. We know the heliocentric positions of P and the center of the earth at any time t and we ask to find the *apparent* geocentric position of P at an arbitrarily chosen epoch T. The solution of this problem can be obtained only by putting a number of restrictions on it; to mention but one, we have to keep the interval of time $T - t$ sufficiently small in order to hold the difference between the observed and computed position below an assigned quantity. The contents of the various chapters of the book in question furnish in

turn the steps by which the solution of this problem is accomplished. KURT LAVES.

Vorlesungen über technische Mechanik. Von AUGUST FÖPPL. Dritte Auflage. Bd. 1 : *Einführung in die Mechanik*, xvi + 428 pp.; Bd. 3 : *Festigkeitslehre*, xvi + 434 pp. Leipzig, B. G. Teubner, 1905.

THE valuable and highly popular work of Föppl on technical mechanics, which began its publication about ten years ago and rapidly ran into a second edition, is now appearing in a third edition of which the first and third volumes are already printed. The present plan calls for no serious changes in the text * other than an expansion into five volumes, the last of which is to contain a considerable amount of matter important for students of technical mechanics but somewhat more advanced than properly finds a place in the general fundamental lectures which fill the first four volumes.

The first or introductory volume still adheres closely to the original maxims of the author, namely, that mechanics is in reality a branch of physics and should be thus presented to beginners, and that no material should be inserted merely because some persons of special and restricted point of view might call for it. One of the most admirable features of the volume is its presentation of the elements of elasticity and hydromechanics in addition to the discussion of the mechanics of a particle and rigid body. It is probably true, and as such it is certainly regrettable, that the great majority of students leave the subject of mechanics after a course by no means meagre with the conviction that mechanics means merely the equilibrium and motion of a particle or rigid body. There is no great difficulty in giving even beginners a realizing sense of the fact that the subject is broader, that the general laws are equally applicable to the study of continuous distributions of matter. This, however, can only be accomplished by thorough adherence to the principle that mechanics is physics rather than mathematics and by a sacrifice of problems which involve complicated mathematical treatment. This the author does with great discretion. His students need not be experts at calculus and analytic geometry to be able to follow with

* An extended review of the four volumes as they appeared in the second edition was given in the BULLETIN, volume 9, pp. 25-35, 1902.