THE LUNAR THEORY.

Traité de Mécanique Céleste. Vol. III. Perturbations des planètes d'après la méthode de Hansen; théorie de la lune. By F. TISSERAND. Paris, Gauthier-Villars, 1894. 4to, pp. 424.

IT is somewhat strange that a subject like the lunar theory, which has received so much attention since its first principles were given by Newton, should be allowed to pass its second centenary before the appearance of a treatise like the present one. Every writer on the subject up to the present time has given a theory from one point of view only—either his own or further developments of some previous one. It has been reserved for M. Tisserand to give us in a collected form the principal methods which have been used to obtain a practical solution of a problem which can be stated in the very simplest terms, but which is perhaps one of the most difficult to master in the whole range of applied mathematics. And its difficulties are not merely those of simple analysis. The results obtained have been generally considered of little value unless they either assist us in the solution or are of value in the practical applications or finally help towards giving a geometrical (intuitive) idea of the meaning of the various expressions arrived at. The geometrical representations have always been kept prominently in the foreground, perhaps owing to Newton's influence, whose idea of the variable ellipse, developing itself naturally from his methods, has been used almost without exception by every writer since his time. In the last few years some doubts have been raised as to whether the ellipse is the most valuable starting-point, and of these I shall speak later in connection with the works of Adams, Gyldén, and Hill. At the same time it must not be forgotten that the complete problem of the motion of the moon is a single one only in the sense that the erection of a house is so—we might use perhaps one kind of material only which may suffice for every portion, but which would hardly produce the most finished results. And thus M. Tisserand in making a collection of methods is not merely giving us a series of disconnected solutions, but furnishes the materials for a building which completed would comprise parts of perhaps every one. This is well illustrated by Dr. Hill's contributions in recent times. He uses in giving a new method of initial treatment Euler's plan of dividing up the various classes of inequalities: for the class of inequalities depending on the figure of the earth Delaunay's method of the variation of arbitrary constants, and, for the inequalities produced by the motion of the