

42.
Is the New-
tonian for-
mula an
ultimate
law?

capable of finding out the ultimate properties of things, is a question which has been answered in opposite ways. But whatever the answer may be to this philosophical question, the further and more modest question can be raised, Does the gravitation formula express one of those universal facts which we have to accept as final, beyond or behind which we cannot penetrate? Opposite answers have been given to this question. But it stands very much in the same position in which Laplace left it when he said:¹ "The extreme difficulty of the problem referring to the system of the universe obliges us to have recourse to approximations, which leave room for the fear that the neglected quantities may have a sensible influence on the results. As soon as mathematicians by observation became aware of this influence they returned to their analysis: by rectifying the same they have always found the cause of the observed anomalies; they have determined the laws of these, and frequently they have outrun observation by discovering irregularities which had not yet been observed. The lunar theory, the theory of Saturn, of Jupiter and his satellites, offer many examples of this kind."² Thus we may say that nature herself has helped in perfecting the astronomical theories founded upon the

43.
Laplace's
opinion.

¹ Exposition du Système du Monde, 6th ed., p. 318.

² Tisserand, in discussing the difficulties which still beset the lunar theory, and after referring to the "prix Damoiseau" offered by the Academy of Sciences for an essay on this subject, says ('Bulletin astronomique,' 1891, vol. viii. p. 501): "La théorie de la lune se

trouve arrêtée par la difficulté que nous venons de développer; déjà à l'époque de Clairaut la gravitation universelle paraissait impuissante à expliquer le mouvement du périhélie; elle triomphera encore du nouvel obstacle qui se présente aujourd'hui, mais il reste à faire une belle découverte."