

Thus the secular inequalities of the celestial motions, like all the others, confirm the law of universal gravitation. They are called "secular," because ages are requisite to unfold their existence, and because they are not obviously periodical. They might, in some measure, be considered as extensions of the Newtonian theory, for though Newton's law accounts for such facts, he did not, so far as we know, foresee such a result of it. But on the other hand, they are exactly of the same nature as those which he did foresee and calculate. And when we call them *secular*, in opposition to *periodical*, it is not that there is any real difference, for they, too, have their cycle; but it is that we have assumed our *mean* motion without allowing for these long inequalities. And thus, as Laplace observes on this very occasion,³⁰ the lot of this great discovery of gravitation is no less than this, that every apparent exception becomes a proof, every difficulty a new occasion of a triumph. And such, as he truly adds, is the character of a true theory,—of a real representation of nature.

It is impossible for us here to enumerate even the principal objects which have thus filled the triumphal march of the Newtonian theory from its outset up to the present time. But among these secular changes, we may mention the Diminution of the Obliquity of the Ecliptic, which has been going on from the earliest times to the present. This change has been explained by theory, and shown to have, like all the other changes of the system, a limit, after which the diminution will be converted into an increase.

We may mention here some subjects of a kind somewhat different from those just spoken of. The true theoretical quantity of the Precession of the Equinoxes, which had been erroneously calculated by Newton, was shown by D'Alembert to agree with observation. The constant coincidence of the Nodes of the Moon's Equator with those of her Orbit, was proved to result from mechanical principles by Lagrange. The curious circumstance that the Time of the Moon's rotation on her axis is equal to the Time of her revolution about the earth, was shown to be consistent with the results of the laws of motion by Laplace. Laplace also, as we have seen, explained certain remarkable relations which constantly connect the longitudes of the three first satellites of Jupiter; Bailly and Lagrange analyzed and explained the curious librations of the nodes and inclinations of their orbits; and Laplace traced the effect of Jupiter's oblate figure on their motions,

³⁰ *Syst. du Monde*, 8vo, ii. 87.