

tro-magnetic, and organic processes. Newton* even distinguished *the attraction of masses*, as manifested in the motion of cosmical bodies and in the phenomena of the tides, from *molecular attraction*, which acts at infinitely small distances and in the closest contact.

Thus we see that among the various attempts which have been made to refer whatever is unstable in the sensuous world to a single fundamental principle, the theory of gravitation is the most comprehensive and the richest in cosmical results. It is indeed true, that notwithstanding the brilliant progress that has been made in recent times in stœchiometry (the art of calculating with chemical elements and in the relations of volume of mixed gases), all the physical theories of matter have not yet been referred to mathematically-determinable principles of explanation. Empirical laws have been recognized, and by means of the extensively-diffused views of the atomic or corpuscular philosophy, many points have been rendered more accessible to mathematical investigation; but, owing to the unbounded heterogeneousness of matter and the manifold conditions of aggregation of particles, the proofs of these empirical laws can not as yet by any means be developed from the theory of contact-attraction with that certainty which characterizes the establishment of Kepler's three great empirical laws derived from the theory of the attraction of masses or gravitation.

At the time, however, that Newton recognized all movements of the cosmical bodies to be the results of one and the same force, he did not, like Kant, regard gravitation as an essential property of bodies,† but considered it either as the

* Adjicere jam licet de spiritu quodam subtilissimo corpora crassa pervadente et in iisdem latente, cujus vi et actionibus particulæ corporum ad *minimas distantias* se mutuo *attrahunt* et contiguæ facta coherent.—Newton, *Principia Phil. Nat.* (ed. Le Sueur et Jacquier, 1760), Schol. gen., t. iii., p. 676; compare also Newton's *Optics* (ed. 1718), Query 31, p. 305, 353, 367, 372. (Laplace, *Syst. du Monde*, p. 384, and *Cosmos*, vol. i., p. 63 (note).)

† Hactenus phænomena cœlorum et maris nostri per vim gravitatis exposui, sed causam gravitatis nondum assignavi. Oritur utique hæc vis a causa aliqua, quæ penetrat ad usque centra solis et planetarum, sine virtutis diminutione; quæque agit non pro quantitate superficialium particularum, in quas agit (ut solent causæ mechanicæ), sed pro quantitate materiæ solidæ.—Rationem harum gravitatis proprietatum ex phænomenis nondum potui deducere et hypotheses non fingo. Satis est quod gravitas revera existat et agat secundum leges a nobis expositas.—Newton, *Principia Phil. Nat.*, p. 676. "To tell us that every species of things is endowed with an occult specific quality, by which it acts and produces manifest effects, is to tell us nothing; but to derive