

the five steps made at once, formed not a leap, but a flight,—not an improvement merely, but a metamorphosis,—not an epoch, but a termination. Astronomy passed at once from its boyhood to mature manhood. Again, with regard to the extent of the truth, we obtain as wide a generalization as our physical knowledge admits, when we learn that every particle of matter, in all times, places, and circumstances, attracts every other particle in the universe by one common law of action. And by saying that the truth was of a fundamental and satisfactory nature, I mean that it assigned, not a rule merely, but a cause, for the heavenly motions; and that kind of cause which most eminently and peculiarly we distinctly and thoroughly conceive, namely, mechanical force. Kepler's laws were merely *formal* rules, governing the celestial motions according to the relations of space, time, and number; Newton's was a *casual* law, referring these motions to mechanical reasons. It is no doubt conceivable that future discoveries may both extend and further explain Newton's doctrines;—may make gravitation a case of some wider law, and may disclose something of the mode in which it operates; questions with which Newton himself struggled. But, in the mean time, few persons will dispute, that both in generality and profundity, both in width and depth, Newton's theory is altogether without a rival or neighbor.²³

The requisite conditions of such a discovery in the mind of its author were, in this as in other cases, the idea, and its comparison with facts;—the conception of the law, and the moulding this conception in such a form as to correspond with known realities. The idea of mechanical

²³ The value and nature of this step have long been generally acknowledged wherever science is cultivated. Yet it would appear that there is, in one part of Europe, a school of philosophers who contest the merit of this part of Newton's discoveries. "Kepler," says a celebrated German metaphysician,* "discovered the laws of free motion; a discovery of immortal glory. It has since been the fashion to say that Newton first found out the proof of these rules. It has seldom happened that the glory of the first discoverer has been more unjustly transferred to another person." It may appear strange that any one in the present day should hold such language; but if we examine the reasons which this author gives, they will be found, I think, to amount to this: that his mind is in the condition in which Kepler's was; and that the whole range of mechanical ideas and modes of conception which made the transition from Kepler and Newton possible, are extraneous to the domain of his philosophy. Even this author, however, if I understand him rightly, recognizes Newton as the author of the doctrine of Perturbations.

I have given a further account of these views, in a *Memoir On Hegel's Criticism of Newton's Principia*. Cambridge Transactions, 1849.

* Hegel, *Encyclopædia*, § 270.